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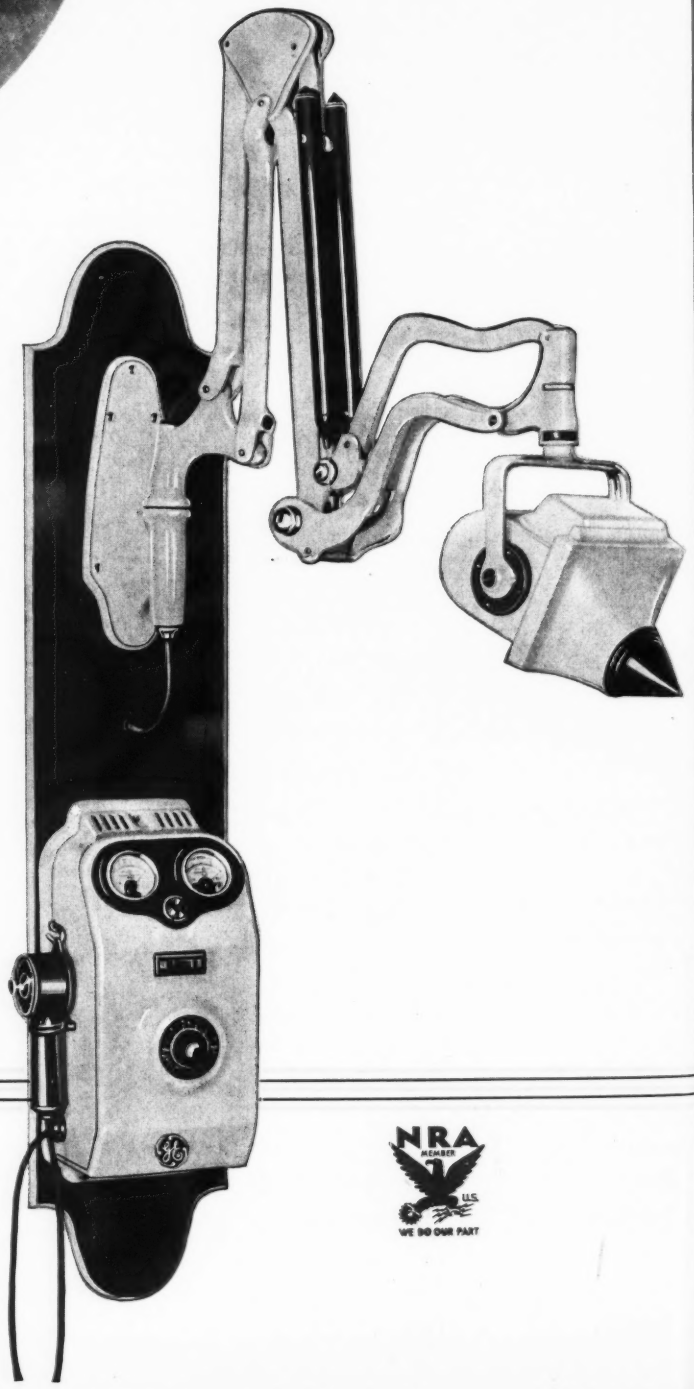

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# The DENTAL DIGEST

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# THE USE OF THE INTERMAXILLARY MATRIX IN FULL DENTURE CONSTRUCTION

HENRY E. ROSTOV, D.D.S.
Baltimore

PROSTHETIC dentistry has become an exacting and definite science. Tremendous progressive studies have been contributed by prosthodontists over a period of years. The specialist is able to construct amazingly accurate and comfortable dentures. For the general practitioner of dentistry to accomplish these same results ordinarily requires a great deal of additional study, of time, and of special instruments. It is because of this fact I am convinced that the great majority of dentists are simply taking impressions, building bite blocks, establishing the lip lines, curve of Spee, rest space, and centric occlusion, and building their dentures with these as guides. The technique presented here may be added to the usual procedure employed by this large group of dentists in a number of selected cases without additional instruments of study, and a saving of time.

It is an accepted fact that the removal of a single tooth causes the beginning of the breaking down process of the jaws. With each succeeding extraction, varying changes occur. Teeth drift to fill in the spaces caused by the extraction of teeth; they elongate to fill in the spaces allotted to the missing antagonists; the patient favors first one side and then the other in mastication, depending on which side is more comfortable. This, in turn, causes nonsymmetrical development of the various muscles of mastication. Teeth become abraded and are forced out of normal positions as time goes on, calling for a difference in the temperomandibular articulation. Owing to these progressive conditions the bite changes with the ridge relationship and the nasi-mental distance.

Patients who have reached the stage where full dentures are required, as a general rule, no longer are young. All the changes already mentioned have been progressing in their mouths over a period of years. These changes naturally have been slow and gradual and allowed the patients to become accustomed to each new condition as it became evident. The changed relationship, I believe, becomes normal for these patients, with some exception, regardless of how far from the recognized normal standard it may have departed. It is this position of the articulating complements that dentists should strive to maintain when constructing dentures. Any change from this final position of the ridges, when there are several occluding teeth still standing in the processes, even though they may tend toward a more recognized perfect condition, thrusts on the patient an unnecessary period of readjustment and repositioning of his jaws which is always accompanied with discomfort and probably pain.

I believe that the technique about to be described accurately and unquestionably leaves the patient with the same vertical and horizontal ridge relationship, the same rest space, the same closure of the jaws, the same interdental space, and the same centric occlusion when the completed dentures are inserted as before the last few remaining teeth have been extracted—and this position is the most satisfactory and comfortable for that particular patient. In order to make use of the following technique, it is necessary to see the patient before the extraction of the final few remaining teeth; that is, it is essential that there be standing in each arch several teeth (of these, at least two must be in antagonistic contact); in addition several well healed edentulous spaces should be present. The patient possessing these requirements and about to become edentulous has in his mouth information which it is well to make use of later on in the construction of dentures and which the profession has for the most part neglected to use.

## TECHNIQUE

1. It is necessary during the preextraction visit of the patient to note the shades of the remaining teeth, to take two good compound or Dentocoll impressions, one of the upper and one of the lower arches, and to take the wax bite.

2. The patient's teeth may then be removed and the patient dismissed until it is advisable to take the impressions of the edentulous mouth. The duration of the edentulous period to which the patient is subjected depends on the patient and the dentist; that is, it is of no importance in so far as this technique is concerned.

3. Plaster casts are poured of the impressions taken and by use of the bites, if necessary, mounted on a plain line articulator.

Exactly the same procedure has been followed up to this point as would be followed if partial dentures were to be made.

Fig. 1 illustrates the casts mounted on the articulator with the position of the upper as related to the lower duplicated accurately.

4. At this stage an intermaxillary matrix is constructed. This may be done any time after the *dentulous* casts are mounted on the articulator and before the *edentulous* casts are mounted.

The matrix is made of wax, but compound may be used, if desired. I use two thicknesses of red wax, adapting the first one thickness well over the palate, then I embed a thin layer of lead foil (x-ray film foil) to lend a little strength and stability, and then another thickness of wax is heated and adapted over the lead foil.

5. A roll of wax sufficiently long to cover the entire arch and of a diameter great enough to fill the interdental space is then softened, placed over the remaining teeth and arch, and the articulator is closed. This causes the teeth to be forced into contact through the wax and also gives the impression of the edentulous spaces of the upper and lower arches.

6. While still soft the wax is well adapted and pressed with the fingers against the teeth and ridges from the facial and lingual surfaces.

7. This roll is then sealed with a hot spatula to the wax previously adapted over the palate, smoothed and trimmed.

Figs. 2 and 3 show two views of the intermaxillary matrix in place over the mounted dentulous casts, the casts upon which the matrix was constructed. Some windows have been cut out of the facial surface of the matrix to show the positions of the teeth. Fig. 4 is an inferior view of the intermaxillary matrix and Fig. 5, a superior view.

The intermaxillary matrix is in reality an impression of all the areas

Fig. 1

Fig. 1—Dentulous casts mounted on articulator.

Figs. 2 and 3—Two views of the intermaxillary matrix in place over the mounted dentulous casts.

Fig. 4—Inferior view of the intermaxillary matrix.

Fig. 5—Superior view of the intermaxillary matrix.

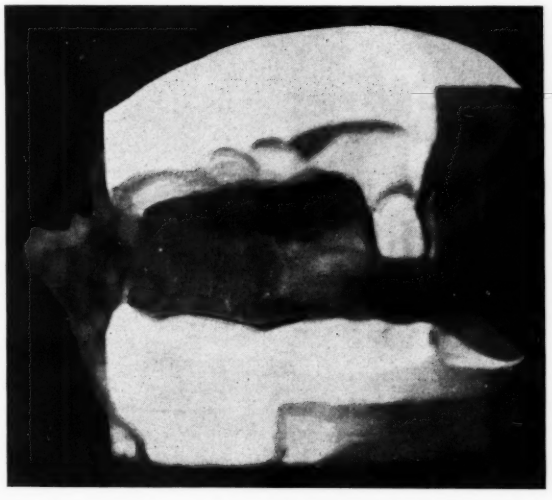

Fig. 2

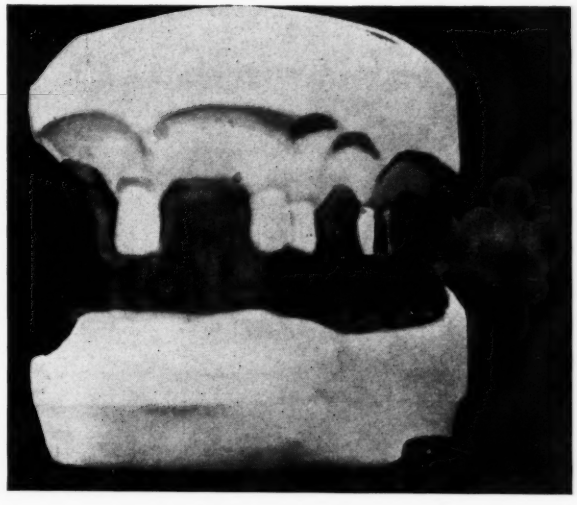

Fig. 3

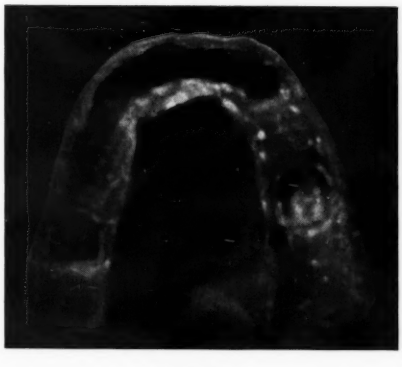

Fig. 4

Fig. 5

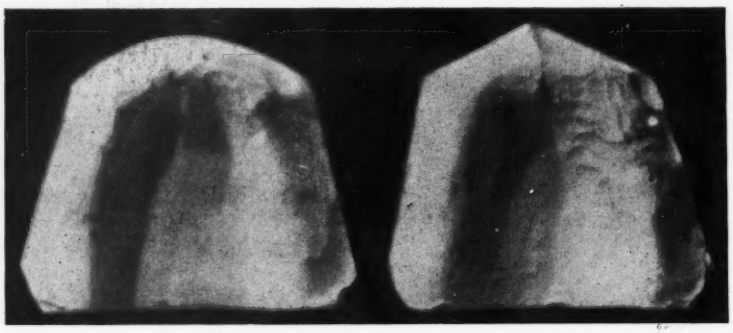

Fig. 6

Fig. 6—Casts poured of impressions of edentulous arches.

Fig. 7—Casts fitted into intermaxillary matrix.

Fig. 8—Case mounted on articulator with intermaxillary matrix in place.

Fig. 9—Mounted casts with intermaxillary matrix removed.

Fig. 10—Bite blocks placed in articulator.

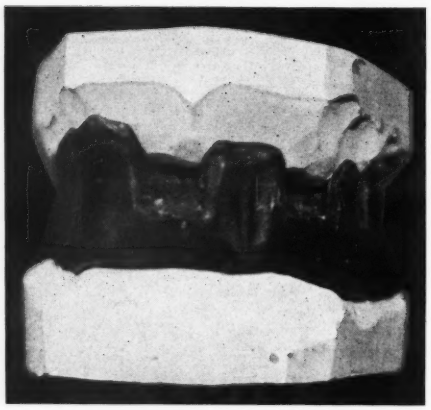

Fig. 7

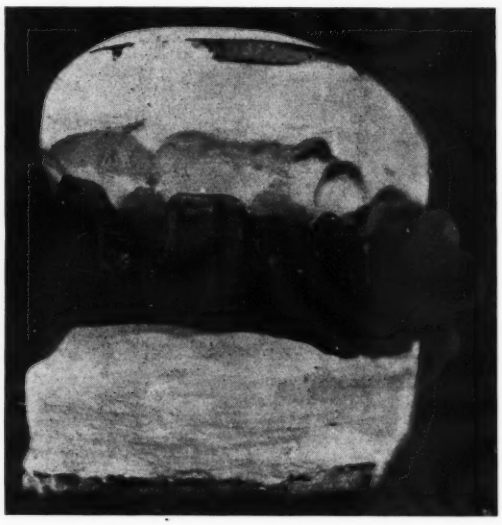

Fig. 8

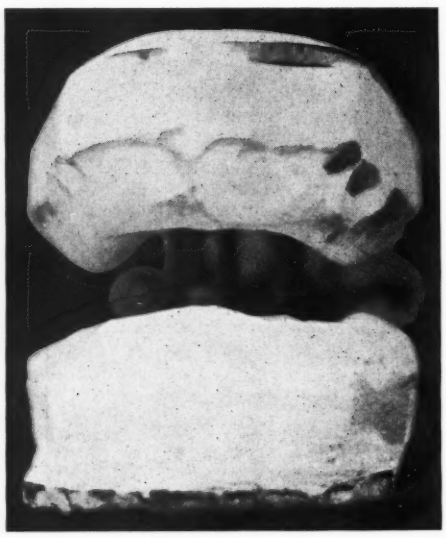

Fig. 9

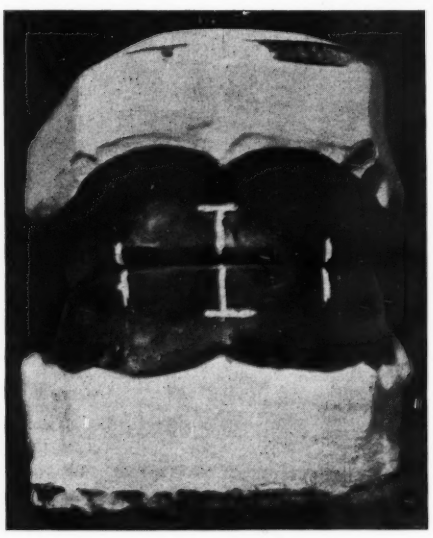

Fig. 10

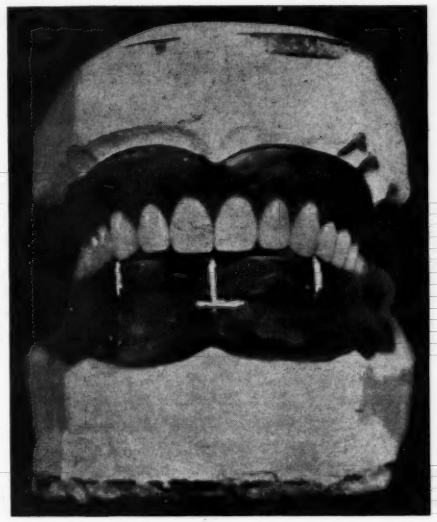

Fig. 11—Upper set up to the lower bite block.

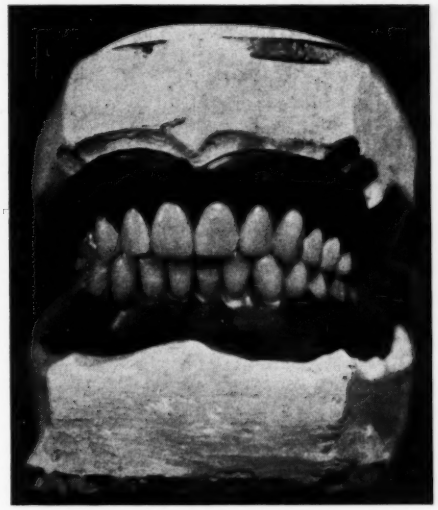

Fig. 12—Finished set-up.

of both arches which are not subject to any change after the extraction of the teeth and healing of the ridges, the palate, and the well healed edentulous spaces. It is a record of the interdental space, the ridge relationships, comfortable occlusion, and the bite to which the patient is accustomed.

8. After the sockets of the most recent extractions have properly healed, impressions of the edentulous arches are taken, any technique being employed with which the dentist is familiar and has been getting good results.

9. Casts are poured of these impressions, as shown in Fig. 6, which are fitted into the intermaxillary matrix as shown in Fig. 7. There will be sufficient area of both upper and lower arches, which were subject to no change as a result of the extraction of the teeth and the healing of the sockets, covered by the matrix to convince the dentist that the casts are seated properly.

10. The case is then mounted on an articulator with the intermaxillary matrix in place as shown in Fig. 8. A definite reproduction of the condition of the patient's mouth on his first visit has been carried over to the articulator. Fig. 9 shows mounted casts with intermaxillary matrix removed.

11. Bite blocks are built on the casts and tried in the mouth where the median line, high lip lines, low lip lines, cuspid lines, and so on are marked on the bite blocks.

12. A curve of Spee is determined in the usual manner.

It is not necessary to attempt to secure centric occlusion or the closure of the jaws or the rest space or the sum length of the two bite blocks—all these have been taken care of by the intermaxillary matrix.

13. The bite blocks are placed in the articulator (Fig. 10). Fig. 11 illustrates an upper set up to the lower bite block, the determined lines being used. Fig. 12 demonstrates the finished set-up.

14. The fundamental rules of setting up teeth are followed in these cases. The dentulous cast may be used at this time as a study model, assuming anterior teeth were present on the patient's original visit, to help set these teeth on the denture in the same positions as the original teeth were. Any peculiarities or positions of these teeth are copied together with the mold. The set-up in wax may be tried in the mouth and corrections of the teeth may be made then.

No provision is made for lateral articulations or protrusive articulation, unless the dentist desires to use an anatomic articulator. With the established relationship as centric, the lateral and protrusive check bites are secured. The face bow is used for transfer from mouth to anatomic articulator.

## Requirements and Contraindications

In addition to the aforementioned requirements of having several remaining teeth in contact and a few well healed edentulous spaces distributed over the arches in order to consider the case an intermaxillary one, several other conditions must be taken into consideration: A case in which the progressive destructive processes of the arches have resulted in a gradual drifting of the lower jaw into a marked abnormal protrusive relationship, automatically eliminates the possibility of using the intermaxillary matrix, since this technique makes no attempt to reproduce in the dentures any glaring deformities of the jaws. It is also unwise to attempt this kind of reconstruction in cases in which the vertical dimensions of the face have diminished to such an extent that an opening of the bite is indicated in the construction of the dentures. The individual dentist must use his discretion in determining his cases. If in his mind a change in the position of the arches or a repositioning of the mandible will result in a more satisfactory denture, either from an esthetic standpoint or from a functional standpoint, the intermaxillary matrix is contraindicated.

## Conclusion

Most of the mastication done by patients is done in the median line, and I believe by maintaining the accustomed positions of the jaws a better set of dentures may be had.

It is important to be careful to select cases in which the use of the intermaxillary matrix may be employed to advantage.

3655 Park Heights Avenue.

# A PARTIAL LOWER DENTURE TECHNIQUE

R. W. BURCH, D.D.S.
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THE best solution to the difficult problem of partial lower denture construction which I have found in my experience is herewith reported. The case shown is of the type most frequently encountered but the same principles apply to the majority of cases.

1. A model is made of the case as shown in Fig. 1.

2. A strip of pink base plate wax (of the kind commonly used) is cut about the size of the bar indicated in Fig. 1, A. The wax is warmed slightly in the central portion and adapted to the lingual of the lower incisors as shown in Fig. 3. This wax is to form the pattern for our lingual bar.

In order to insure a good anchorage of the finished bar, the wax must be adapted to the space X in Fig. 2. It is necessary to have the porcelain teeth in place so that the wax bar can be shaped to the best advantage; that is, the case must be mounted on an articulator, a cast of the upper teeth being used together with a bite.

As it is desirable to have the entire space X left open on the lingual side for the fitting of the wax bar under these teeth, I use a small amount of plaster, shown at D, Fig. 2, to hold these porcelain teeth in place. If one is especially careful it is easy to hold the teeth in place with the pink wax used to form the denture shape but the wax should be placed on the buccal side only. By warming one end of the wax bar A (Figs. 1 and 3) at a time and gently tucking it under the porcelain teeth a perfect anchorage is formed.

To remove this wax pattern from the model it is necessary to remove the teeth from at least one side so that the wax can be removed without distortion.

Most lingual bars are small and more or less springy, which is one cause for their failure. The bar described here is stiff and rigid. The general shape and size of the bar is as here indicated. It is the common practice to place the bar below the free gum line, but I have had best results by placing it as indicated; that is, it should center at the gum line, extending up the lingual of the lower teeth and about equal distance below the gum line. This forms what might be called a partial gold lingual saddle.

Regular cast clasp gold is the best to use, but the cost may be greatly reduced by casting from good scrap gold. When scrap gold is used the bar should be made a little stronger as used gold is liable to crystallize in casting, thus losing part of its strength. Gold that has been cast two or three times should not be used. But in case the gold used is questionable, it can be reenforced by a layer of 20-K solder on the lingual side. Each end of the bar where it is embedded should be shaped to insure retention. One or two holes as indicated at E, Figs. 1, 3, 6, are helpful.

The greatest force to dislodge any denture is the force of mastication. Clasps have little use under this stress. Their function is gently to retain the appliance in place against the movement of the tongue or other muscles. I wish to make it clear that nothing will take the place of correct articulation and an absolutely stiff lingual bar. Many cases are troublesome because of poor clasp construction. Often the clasps are more harmful than helpful. I believe by studying the mechanics of the swinging pendulum as in Fig. 4, light is thrown on the principle that should be used. The weight of the pendulum or plumb bob is always pulling downward on the seat of the stool. A wide range of movement of the plumb bob in any direction will not upset the stool. This, then, is the principle underlying my clasp design.

Fig. 5 is a diagrammatic cross section of a cuspid showing the plumb bob or pendulum action of clasp B. This clasp pulls in the direction of the arrow. In this case the point, Z, compares to the plumb bob while the cross section or bar, A, is like the stool seat.

In actual construction it is not an easy matter to accomplish this result. With a round instrument a depression is made in the wax pattern at point C (Figs. 3, 5, 6) where the clasp is to pass through the bar. A small hole can be planned to appear in the finished casting in the center of this depression for the clasp wire to go through, or the hole can be drilled after casting. As this is to be a ball and socket joint the clasp wire must not bind in passing through the bar at point C. A ball is easily formed on the end of the clasp wire by holding in a hot flame and melting to a bead.

The cast bar is placed in position as in Fig. 3, then clasp wire with ball is threaded through the bar and bent around the cuspid. One should be sure that the clasp wire does not touch on more than two points; that is, at the ball joint, C, and at point Z on the buccal side of the tooth. If the free movement of the clasp is hindered by touching other points than these the plumb bob effect is lost. Results can be tested by assembling the case as in Fig. 3 and attempting to dislodge the cast bar, A. If the bar can be easily dislodged from the model then the clasp or clasps that are not holding should be readjusted.

The porcelain teeth are now placed back into the original position and waxed up. It may appear that the pendulum effect is lost when clasp B is anchored by vulcanite, but it is not. Great care is required, however, when finishing and polishing not to bend the clasps. If the clasps are once bent from their original position, it is necessary to remove all vulcanite from around the clasps to insure free pendulum movement. Broken clasps can be repaired by inserting new ones. The depression at joint C is usually deep enough so that the ball end of the clasp is covered by vulcanite. In case a new clasp is to be inserted, however, the vulcanite is cut away to expose the ball end of the broken clasp. The new clasp now inserted must also be enlarged at its free end so that it will not fall out when the denture is being handled or cleaned (Fig. 8). Fig. 6 shows the manner of mounting the wax pattern on the sprue for casting. This is the same technique as used for casting an inlay. A stiff wire across from E to E will prevent distortion while investing.

Fig. 7 is a modified form of lingual bar in which one central incisor is soldered to the bar. In such cases no clasps are required. In case the natural teeth remaining are very much worn down or short, the bar is modified by extending it upward nearly to the incisal edge, or even flush with

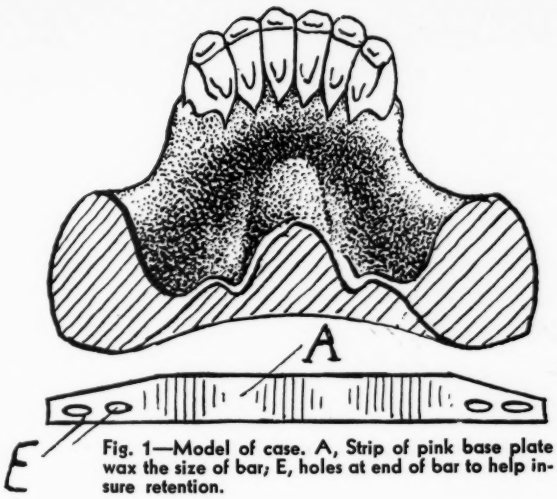


Fig. 1—Model of case. A, Strip of pink base plate wax the size of bar; E, holes at end of bar to help insure retention.

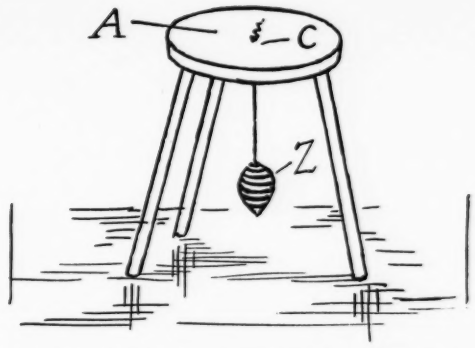


Fig. 4—Principle of swinging pendulum illustrated to show underlying principle of clasp design.

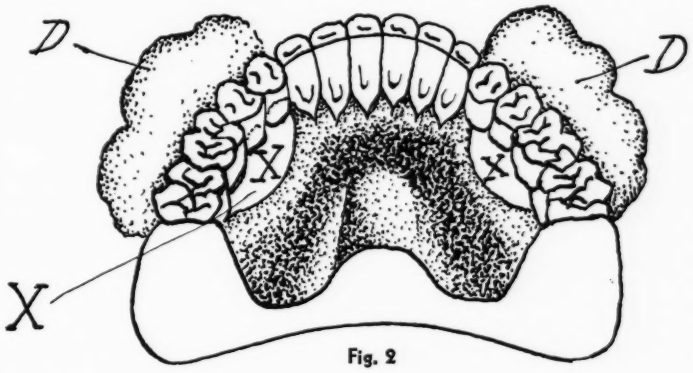


Fig. 2

Fig. 2—X, Space to which wax is adapted; D, plaster holding porcelain teeth in place.

Fig. 3—Wax adapted to lingual of lower incisors; A, cast bar; B, clasp; C, hole for clasp wire to go through; Z, corresponding to plumb bob.

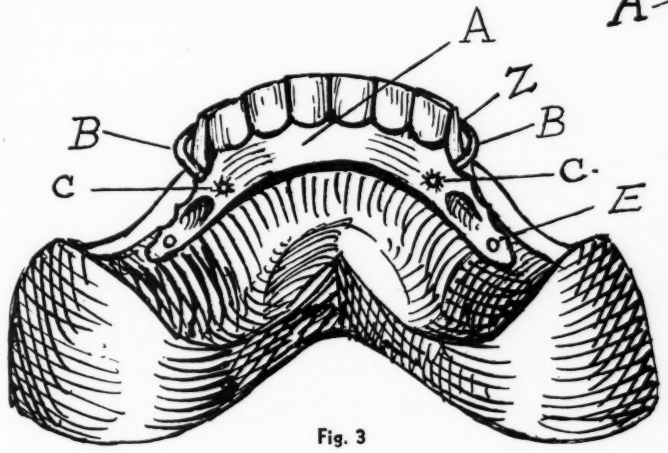


Fig. 3

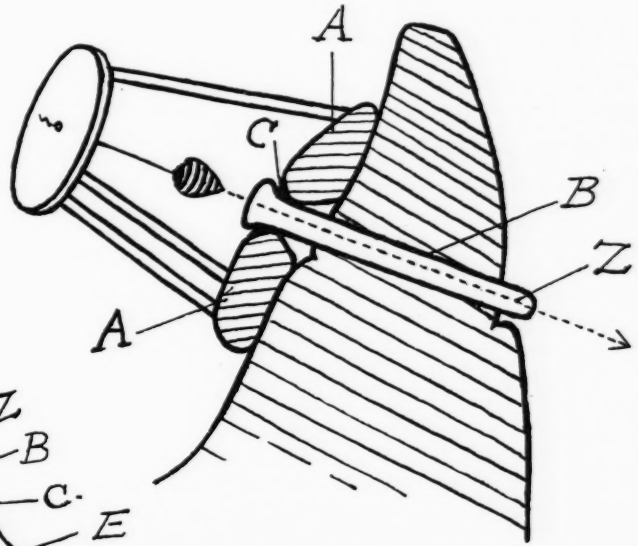


Fig. 5—Diagrammatic cross section of cuspid showing plumb bob or pendulum action of clasp B. Point Z compares to plumb bob; A, cross section of bar is like the stool seat in Fig. 4; C, hole for clasp wire as in Figs. 3 and 6.

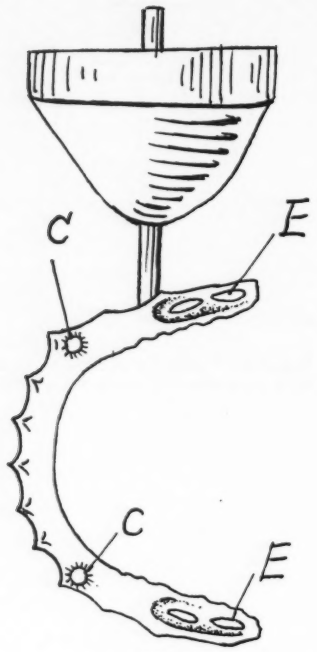


Fig. 6

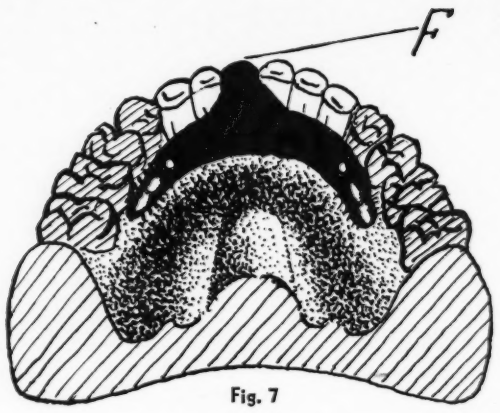


Fig. 7

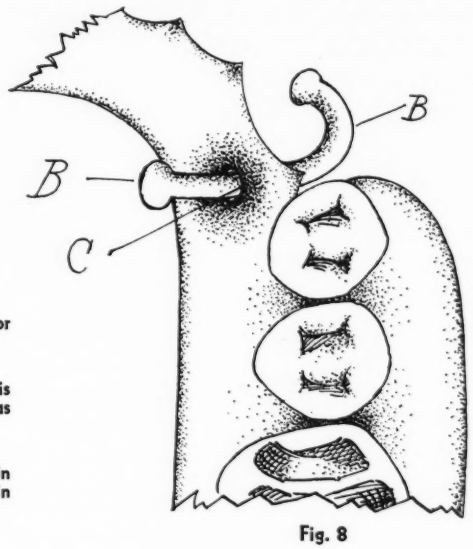


Fig. 8

**Fig. 6—Mounting wax pattern on sprue for casting; C, hole for clasp wire; E, holes shown in Fig. 1.**

**Fig. 7—Modified form of lingual bar in which one central incisor is soldered to the bar. No clasps are required; F, point that serves as fulcrum.**

**Fig. 8—Clasp B out of working position. It slides through hole C in bar and comes to its working position when denture is in position in the mouth.**

the edge in extreme cases. The point F then serves as a fulcrum, giving the clasp a good leverage to hold the bar from being lifted at the distal.

It will be observed that in these cases of short teeth, and consequently short bite, it is difficult to make the clasp stay down. In other words, the curvature of the labial wall of a lower cuspid may offer no anchorage for the clasp. This can be easily remedied by inserting a small gold inlay just above the clasp and leaving a protruding catch for the clasp.

The clasp, B, as shown in Fig. 8, is out of working position. It slides through the hole, C, in the bar and comes to its working position when the denture is in position in the mouth.

While I have found this loose clasp construction to be entirely satisfactory, especially for cases of long bite, it will not do for short bites. The clasp should be in position and holding well before soldering. A pinch of solder and a hot flame at point C, and the stone model will not be injured. The loose clasp construction is shown more to bring out the principle than to recommend it in all cases.

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The biography of C. J. Stansbery, D.D.S., appeared in the April, 1933, issue of THE DENTAL DIGEST.

# COMPLETE FULL DENTURE TECHNIQUE

## VIII. COMMENTS AND SUMMARY

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IN THIS concluding installment of the Tripod technique the principal points will be reviewed in such a way as to include further explanation of procedures that have been the subject of inquiries by THE DIGEST readers.

1. Attention has been called to the fact that in the preextraction visit no mention was made of the roentgenographic method for the making of the facial templet. This was purposely omitted as all templets so made are enlargements of the true facial outline. These templets are made by having the plate or film held parallel to the patient's sagittal plane against the side of the face, necessarily about 4 inches from the sagittal plane. The x-ray tube is placed to the opposite side from 5 to 10 feet distant, so that the rays fall at right angles on the plate. When placed 5 feet, or 60 inches, from the sagittal plane the tube will be 64 inches from the plate or film. The result is that a distance of 60 mm. on the patient's profile will register as 64 mm. on the roentgenogram, or one-fifteenth enlargement. The average usable length of a facial templet is 120 mm.; an enlargement to 128 mm. would make it useless. At a tube distance of 10 feet the error would still be 4 mm. The only way in which the denture prosthetist can absorb this error is to increase the distance between the ridges. Any method of constructing templets which allows such gross errors cannot be used in a technique striving for accuracy (Fig. 78).

2. "Why not use the face mask and cast? They are easily made, giving a face profile and more too." The answer to this question may not seem as convincing as the one concerning the roentgenographic profile templets but there is a reason for the omission. The ideal reconstruction of all facial contours by the use of dentures is, at best, beset with difficulties, many insurmountable. This is evidenced by patients bringing photographs of themselves taken from five to twenty-five years previous for the dentist's information as to what they expect of their dentures. The profile line is usually well within the dentist's ability satisfactorily to restore but the restoration to contour around the lower corners of the mouth and the depressions alongside the nose, caused by the absorption of bone overlying the upper half of the extracted cuspids, is quite another matter. With these defects one does the best he can, but why call the patient's attention to them with a full face cast? It is much better to absorb his entire attention in the correctible facial profile than borrow further troubles.

3. While the technique described in the first paragraph of installment 2 (DIGEST, May, 1933) for the construction of the lower vulcanite tray is usable, this method calls for the preparation of this tray as in a case of relining. The preparation of the tray where undercuts are present may demand considerable cutting. To avoid this tray preparation an alternative method is here presented. A modeling compound snap impression is taken of the lower ridge and a plaster cast is poured. This impression is carefully removed from the cast with as little distortion as possible and placed in lukewarm water to maintain its moldability. Over the cast just made two sheets of baseplate wax, of the desired outline of the lower tray, are laid. This wax is chilled and the modeling compound impression immediately reseated. This enlarged impression is now poured and on this second cast the vulcanite tray is made. By this method, when the tray is lined with modeling compound and receives the imprint of the first lower cast taken, a uniform layer of modeling compound will occupy the space created by the two layers of base plate wax.

4. The basis, the central idea of this technique is the patient's requirements obtained by the dentist in a most exacting and logical manner. But, fortunately, by the use of instruments, this is easily done. The task is to construct dentures for the individual patient in our hands; this patient's requirements, his impressions, esthetics, and jaw relationships must be the sole guide of procedure. To fulfill these requirements we have certain materials and instruments. An instrument is "that by which anything is accomplished; a means to an end," and the definition will thus be seen to include materials also. Materials and instruments should be relegated to the secondary place in which they belong. *The dentist should make the denture to fit the patient and not the instrument, using the instrument only to aid him in his accomplishment.*

Every step in this technique is based on understandable logic. The impres-

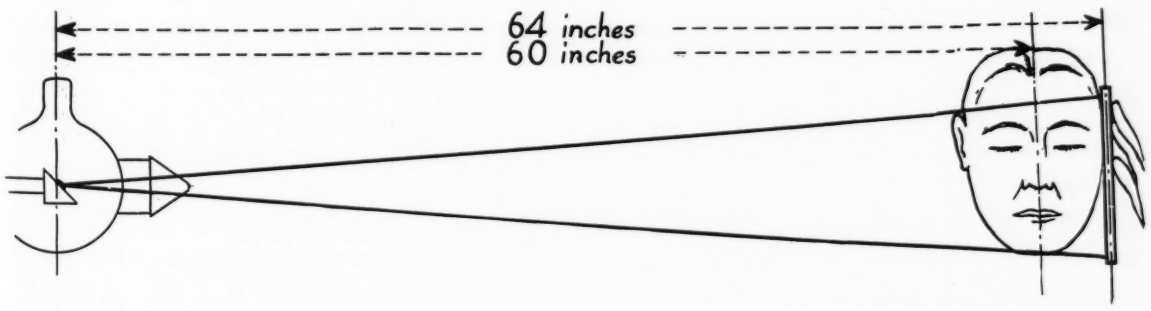


**Fig. 78—The dimension of the profile on the film or plate will be to the actual dimension of the face profile in the same proportion as the distance of the film from the target is to the distance of the median line of the face to the target. In this case, as 60: 64 or 1/15 enlargement.**

sions bear the tissue forms of the finished dentures which under working stress will deliver a uniform pressure to the tissues of the ridges, a relief of tissues overlying blood and nerve supply, and a comfortable and efficient peripheral margin for retention. The check bites are taken at definite functioning jaw relations, these being easily established by the combination of cusp height and definite lateral excursion; no influence other than the patient's own musculature directing natural movements is responsible for the placement of these jaw relations. These check bites are recorded and interpreted into jaw movements by the Denture Tripod. The Tripod has no movement of its own but only the movements derived from the check bites; of equal importance is the fact that it has no restriction nor interference with these movements.

A few years ago a dentist, in discussing dentures with which he was having considerable difficulty, made the remark, "And I made them on a Hanau articulator," said with a tone of finality that indicated, "What more could be done?" This remark showed to what extent many dentists depend on an instrument. He was expecting the articulator, his agent, to do something, to supply something and perfect the result. No criticism of the Hanau instrument is here intended; it might have been any one of many others. The Hanau is without doubt one of the most excellently made instruments that has been given to the profession. At the time of its advent it would do what was required by the users of contacting bite-rim check bites and face-bow measurements. Probably this dentist had encountered one of those patients whose movement of the working condyle precluded the correct duplication on any instrument of hinge construction.

5. Without reservation, this technique is intended as an explicit indictment against the use of contacting bite rims or wax between bite rims for check-bite purposes and articulating instruments that do not allow full freedom of movement of the working condyle. The usual construction of wax or modeling compound bite rims is that the upper bite rim, of approximate tooth length and contour, is attached to the upper base, and the occlusal surface of the bite rim is finished with either a flat or spherically curved surface, and chilled. A softened roll of wax or modeling compound is mounted on the lower base plate, placed in the patient's mouth and the patient instructed to close, thus causing the roll to receive the imprint of the already formed bite rim.

At the moment of contact of this hard upper bite rim with the soft lower, error begins. The mandible is carrying the lower rim not vertically upward but upward and forward; the upward force seats and vertically compresses the underlying ridges. However, the forward or protrusive thrust exerted in the yielding modeling compound of the lower rim shifts the bases horizontally on the ridges, resulting in an erroneous position of the base plates. Under this condition even if the ridges were in correct centric relation the casts would not be, owing to this horizontal shift of the bases. Here, at the initial step of the check bites, is an erroneous registration of centric relation to which the eccentric registrations are to be established. With the flat occlusal surface, notches are generally used in the upper bite rim at molar and incisor regions to form an index and engage the lower in a locked position. These notches add greater horizontal stress and act to preserve the horizontal displacement. If the notches are not used, on relief of biting strain the bases move and release the horizontal displacement. This shift of the denture bases creates uneven pressure on the ridges at future closures.

6. Even more glaring are the errors of eccentric relations with the use of bite rims. The flat and curved bite rims will be considered separately. The use of flat bite rims calls for the use of wax or modeling compound between them for the registration of the eccentric relations, a method fraught with probabilities of great errors. In discussing the method of interposing wax or modeling compound between rims, Doctor Gysi[1] says,

> Careful workers soon discovered that the taking of lateral check-bites was unsatisfactory because it led to great error. They then controlled the lateral check-bites by means of a gothic arch tracing, hoping in this way to escape the errors. But there were causes of error which they did not suspect and could not control.

Concerning experiments at the University of Zurich which Doctor Gysi carried on, he says,

> We found the cause of the error to be that as the soft modeling compound which was placed between the jaws to register the relations was compressed by the relatively cool bite rims, it cooled much more rapidly where it was thin than where it was thick, became harder and made unequal pressure on the bite rims. This pressure was transmitted to the mucous membrane and created a different condition of resiliency in different locations under the bite rims. Furthermore, when being placed in position, the soft modeling compound chilled much more rapidly where our fingers touched it than it did elsewhere, and this created the same uneven pressure on the tissues.

[1] Gysi, Alfred: Research in Denture Construction, J. A. D. A. 16:209 (February) 1929.

If such a careful, expert operator as Doctor Gysi, even while operating on a manikin, where all personal elements of the patient are removed, reports that "By this method we were never able to get the same registration twice," what can the average operator expect with the added complication of various resiliencies and patient control of movement!

In the same article Doctor Gysi compares the extra-oral method with the bite-rim method of determining condyle path inclinations and admits a possible error in the extra-oral method of plus or minus five degrees. He says, "However, since the wax and compound check-bite method develops errors as great as plus or minus twenty-five degrees, I feel safe that we may adopt the first method." This should be sufficient to prove the indictment against modeling compound or wax interposed between bite rims.

The other widely used method is to construct the occlusal surfaces of the bite rim on a spherical surface that will remain in contact during these eccentric excursions. Except for the one case in a thousand this is both theoretically and practically impossible. True, they may appear to be in contact, but only at the expense of tilting and uneven compression of the ridges beneath the base plates. The reason for these foregoing statements should be made clear by the following:

The protrusive movement can take place around any transverse axis drawn through a plane perpendicular to the condyle paths. This axis is usually located 4 inches above the occlusal plane and passes through the point generally accepted as the spherical center of the Monson theory. Variation of the condyle slopes will vary the position of this center point. Bite rims that show circular occlusal surfaces around this axis will remain in contact and not be displaced or tilted on the ridges. The bite rims may lie on the surface of a transverse cylinder or a sphere. A cylinder is here mentioned because attention is directed to the fact that the movement is around an axis and the so-called spherical center is only one of the points on this axis. If the bite rims were spherical in form then this axis would be a fixed transverse diameter of the sphere. In theory this is all right but in practice, to determine the curvature is not so simple. The approximate curvature may be chewed in if the patient restricts his movement to precise protrusion without the slightest lateral inclination.

The left lateral excursion presents another picture. The axis of movement lies from approximately, not necessarily, the exact spherical center

as in protrusion, downward, backward, and outward to the region of the left condyle. Doctor Gysi places the average as inward, downward, and backward of the condyle. Around this axis the same conditions exist as pertained to protrusion. If this axis exactly intersected the axis of protrusion then the spherically formed bite rims would still function.

In the right lateral excursion the axis again changes its position from the approximate spherical center downward, backward, and outward toward the right condylar region. If this axis intersects the two previous axes at their point of intersection then again the same spherically formed bite rims will function in right lateral excursion. When a patient presenting such a condition is found, he will be one who is geometrically and symmetrically made. The condyle paths will be exactly the same and the amount of lateral shift of the condyles, or Bennett movement, will be exactly the same. With such a patient one may succeed in registering centric occlusion (if the gothic arch tracing is used) and the three eccentric positions on the spherical plane of occlusion. Unfortunately these positions are not functioning positions with dentures having cuspated teeth, so why register them? It must also be assumed that with the other geometrical exactitudes the patient will open cusp height and still preserve his symmetry of movement. One in a thousand is a liberal estimate for the finding of such a patient. The 999 seen exhibit condyle paths of different slopes, irregular mandibles, deformed condyle heads, and habits of unilateral chewing to which the mandible has conformed. These patients can also form spherical bite rims for each movement but these spherical forms will not all coincide.

Each movement around its own axis demands a definite sphere and no one sphere can serve for all movements. The discrepancies between the curve used and the various curves the case demands are the source of the tiltings and undue compressions of the underlying ridges. Is it not expecting almost too much that the nonanatomic center, a center projected from the condyle movement, should have sufficient control of the mandible to determine the mandibular movements?

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Doctor George P. Phillips[2] in discussing bite rims and central point of bearing says,

> One difficulty that we have had in trying to reproduce the right, left and forward excursions of the mandible was due to the interference of the occlusal rims which had a tendency to dislodge the trial plates and give erroneous results. This difficulty is entirely overcome by the use of the central bearing idea; that is, when the upper and lower trial plates are held firmly against their respective ridges through a central bearing point, and held in perfect balance while the mandible is allowed to move freely in every possible direction without the slightest interference from the occlusal rims.

In the same article Doctor Phillips was overly charitable and generous to the users of curved occlusal bite rim surfaces when he said,

> Attempts have been made to carve or shape the occlusal rims to harmonize with the mandibular movements. This can undoubtedly be done successfully in the hands of ingenious operators, but is too long and too difficult a process by which to teach beginners and also the general practitioner.

It has been shown that this, in the ordinary case, is impossible and that the tilting to which Doctor Phillips refers exists in all cases except the purely theoretical one-in-a-thousand case previously mentioned. Stated geometically, *the only surface that will remain in sliding contact with an adjacent surface and move around three differently directed axes must be a section of a spherical surface, and this continuous contact is possible only when the three axes intersect at a common point.*

Is it any wonder that techniques based on bite-rim check bites advise rechecking and remounting numerous times? The rechecks are tacit admissions of lack of confidence and more than probable error in the previous checks. Spot grinding after the dentures are supposedly finished is another admission of the failure of the technique employed to finish the dentures accurately. Mouth grinding or chewing-in accurately to correct occlusal surfaces, while the whole denture is supported on a resilient and shifting base, is a mechanical heresy. In the face of such eminent authorities as herein quoted, the current literature is still replete with procedures that do not rate to be called more than stunts based on these discredited check-bite methods.

[2] Phillips, G. P.: Reproduction of Mandibular Movements, J. A. D. A. 17:1492 (August) 1930.

[3] Tench, R. W.: Artificial Dentures, J. A. D. A. 20:1243 (July) 1933.

## Summary

A concise summary of the entire technique presented includes: (1) impressions of denture form exhibiting relief, compression, and retentive periphery; (2) the vertical opening that our judgment tells us will best harmonize with esthetics and function with the abnormal conditions found, owing to muscular and mandibular changes; (3) check bites taken with no preconceived idea of mandibular movement, registering only that which the patient presents, and (4) the transfer of the check bites to a practical and usable three-dimensional instrument which will reproduce with accuracy the positions registered by the patient and permit excursions between these positions. The practicability of the Denture Tripod is in its design of having no guide in the condylar regions but in regions distant from still points where a considerable horizontal movement is shown. This ensures a stable seat for the upper member of the instrument in all its various excursions.

As a final and fitting word for the closing comment on the Tripod technique the following quotation of Doctor Tench[3] is given: "When the dentures are placed in the mouth, if a Stansbery Denture Tripod is used little adjusting of occlusion will be necessary."

THE SEVENTIETH ANNUAL MEETING OF THE CHICAGO DENTAL SOCIETY

February 26, 27, 28 and March 1, 1934

Stevens Hotel, Chicago

# DIET AND DENTAL CARIES*

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IS IMPROPER diet responsible for dental caries? If one subscribes to the belief that it is, two questions logically present themselves: First, how does faulty diet effect this disease? Second, in what respect is the diet improper?

A review of recent investigations on caries leaves one of the opinion that diet does play a part in the etiology of dental caries; but *how* remains a mystery. The theories which have been advanced may be grouped into three general classes. Faulty diet results in (1) altered tooth structure or substance; (2) a change in the quantity or composition of the saliva; (3) an oral pabulum suitable for specific bacterial growth. It is my opinion that none of the theories yet advanced has enough factual proof to support its contentions. As I have expressed my views on this subject in a previous publication,[1] I shall not do so here except to say that I consider the answer to this first question of *how* diet produces caries all-important. If it could be definitely shown by what means nutrition and metabolism effect tooth decay, the research on this problem could proceed on a more unified and concerted basis.

In what respect is the diet improper? That depends on which investigator one happens to be following. Mrs. May Mellanby[2] has stressed the importance of vitamin D while Percy Howe[3] and Hanke[4] emphasize vitamin C. Sprawson[5] thinks immunity may be established by the inclusion of raw milk in the dietary whereas Wallace[6] condemns milk and soft foods as he believes the cleansing power of the diet to be the most beneficial. Martha Jones[7] finds the acid-base balance of the diet related to caries susceptibility while Bunting has decreased the amount of caries in a large group of children by reducing the amount of carbohydrates in the food. Thus opinions vary, although almost all investigators agree with the idea expressed by Boyd and Drain[9] that a diet well balanced and well reinforced in all respects is probably essential for the prevention of dental caries.

Recently emphasis has been placed on the importance of phosphorous for the prevention of caries. Doctor and Mrs. Agnew[10] of the West China Union University and the University of Toronto have reported some interesting experiments conducted on rats in which they were able to produce or inhibit caries by regulating the phosphorous and vitamin D content of the diet. Three hundred and sixty-five animals fed normal diets gave no evidence of caries whereas seventy out of seventy-one animals fed a diet low in phosphorous and vitamin D developed caries. This diet, however, was low in other minerals and vitamins and the proteins were of poor quality. In fact, they found that when the phosphorous was raised to the so-called normal level in the diet, caries was prevented in only four of seven rats or 58 per cent. When the phosphorous was left at its original low level, the addition of vitamin D prevented caries in six of nineteen rats or in only 31 per cent. Thus they state ". . . one could not conclude from these experiments that the caries was due entirely to the low phosphorous content and the absence of vitamin D." The addition of calcium and of vitamins A, B, C, and E did not influence the development of the carious process in their animals. They found no relation between the percentage of bone ash and the incidence of caries. This is contrary to the opinions of some of our investigators, notably, Mrs. Mellanby,[2] Howe,[3] Boyd and Drain,[9] and Weston Price[11] who contend that teeth and bone are more or less analogous and that changes in bone due to dietary deficiencies would probably register before changes in the teeth.

The Agnews concluded from their results that ". . . in the rat, an adequate supply of phosphorous and vitamin D are factors in the prevention of dental caries. This is essentially in accord with the views expressed by McCollum and his coworkers, who stressed the possible importance of these elements as long ago as 1922 . . ." The Agnews express the opinion that while phosphorous is probably the most important factor in producing experimental caries in rats, vitamin D is more important to the human being. This statement is motivated by the fact that caries is prevalent in many persons who consume diets that contain fairly large amounts of phosphorous.

Because of their experiments, the newspapers and several widely read magazines have credited the Agnews with making a startling discovery for dental science. *The Literary Digest*[12] heads an article "Two Missionaries Make a Dental Discovery," "Tooth decay can be warded off by vitamin D and phosphorous in the diet." *Time*[13] tells of Professor McCollum's trip to New York to confirm an important discovery about decayed teeth. The *Chicago Daily Tribune*[14] states, "The first 100% scientific proof of the specific diet which will preserve teeth, namely, phosphorous and vitamin D, was credited today to two missionaries of China, Dr. and Mrs. R. Gordon Agnew." It is difficult to understand why or how such publicity originated, for the Agnews in their scientific publi-

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1Kesel, R. G.: What Do We Know About Dental Caries? J. A. D. A. **19**:903-917 (June) 1932.

2Mellanby, May; Pattison, C. L., and Proud, J. W.: British Med. J. **2**:354 (August) 1924. Mellanby, May; and Pattison, C. L.: British Dent. J. **47**:1045-1057 (October 1) 1926; British Med. J. **2**:1079-1082 (December 15) 1928. Mellanby, May: Med. Research Council, Report number 140, 1929; number 153, 1930; number 159, 1931; Experiments on Dogs, Rabbits and Rats, and Investigations on Man Which Indicate Power of Certain Food Factors to Prevent and Control Dental Disease, J. A. D. A. **17**:1456-1480 (August) 1930.

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4Hanke, M. T.: Relation of Diet to Caries and Other Dental Diseases, J. A. D. A. **16**:2263-2271 (December) 1929; Relation of Diet to General Health and Particularly to Inflammation of Oral Tissues and Dental Caries, J. A. D. A. **17**:957-967 (June) 1930. J. Nutrition **3**:433-451 (January) 1931.

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12Literary Digest, **115**:24 (February 4) 1933.

13Time, **20**:26 (December 19) 1932.

14Chicago Daily Tribune, December 7, 1932, page 14.

cation make no claim for such a discovery. Their theory is not new nor were they the first to suggest it. May Mellanby,[2] Weston Price,[11] McCollum,[15] Klein,[16] and Lennox[17] have stressed previously the importance in the diet of sufficient vitamin D and mineral elements, including phosphorous, for the prevention of caries.

Doctor Hatton[18] in a recent review of our knowledge on this disease quotes from an article in the *Missouri State Dental Journal* published in 1869 as follows: "But when to please public taste the manufacturer of superfine flour robs the wheat grain of four fifths of this phosphate, he is destroying the teeth of his customers." It will be seen, then, that lack of phosphorous was regarded as the culprit more than sixty years ago.

Shelling and Asher now have given a different explanation of the Agnew findings. They feel that the Agnews' results are evidence in support of the theory that the size of the food particles are related to the production of caries in rats. This idea was first suggested by Hoppert, Webber, and Caniff[20] in 1931. It has been substantiated since by Henry Klein[21] and recently by Rosebury, Karshan, and Foley.[22] Shelling and Asher from a study of 150 rats on diets of various compositions for 130 to 1153 days found that the incidence of caries is high in rats on diets containing a large percentage of coarsely ground corn. When the diet was composed of casein and starch or of grains, the particles of which were finer and softer than corn, caries did not occur. The impaction of the coarse corn particles in the deep fissures of the rat molars supposedly produce a physical injury to the tooth surface and so predisposes to caries. The addition of vitamin D to the diet did not lessen the incidence of caries when the diet was composed of coarse corn particles.

Shelling and Asher give the following interpretation to the Agnew findings:

"... the results of the experiments of the Agnews and Tisdall afford a most striking demonstration of the power of diets largely composed of ground corn to produce dental caries in the rat. Thus, of a total of 383 of their rats on cornless diets, 'macroscopic' caries did not develop in a single instance, and 'microscopic' caries occurred only in five animals (1.3 per cent). On the other hand, among 121 rats on the corn-containing diets, counting all animals with doubtful caries as in the caries-free group and including all in which vitamin D and P deficiencies in the diets had been corrected, 112 rats (93 per cent) showed dental caries, i.e., only 7 per cent escaped. In this respect their results are in harmony with those of Hoppert and associates, and of our experiments. The efficacy of dietary P in preventing tooth decay cannot be evaluated from the experiments of the Agnews and Tisdall, since in their experiment, in which sodium pyrophosphate was added to an otherwise low P ration, only eight animals were used."

Weston Price,[11] who has been prolific in his writings on the relation of diet to caries, believes that the mineral and vitamin content of the diet is in a large measure responsible for the dental conditions. He recommends for protection against caries, leafy vegetables and a mixture of the concentrates obtained from certain cod liver oils and certain butters, the richness of which are determined by chemical and biologic assays. He believes that the average diet is deficient in the activators and chemical elements obtained from these substances even though food supposedly containing them are included in the diet. As vegetables grow, certain minerals are removed from the soil and usually are not returned. Consequently, succeeding crops suffer. The same is true of pasturage. Continued grazing without enriching the soil has depleted the mineral content of the cow's diet and as a result has depleted the mineral content of her milk and body tissues. Thus ordinary dairy products and vegetables do not contain sufficient minerals and activators. As a result they predispose to dental caries.

Doctor Price describes a disease termed "loin disease" affecting cows in certain areas in Texas. It is due primarily to a mineral deficiency of the diet and results in death to the animal. He believes an animal has the ability of maintaining the chemical constituents of the controlling mechanisms of the body at relatively constant levels by a system of temporary borrowing from storage deposits in the body. Doctor Price[23] states, "When disturbances appear in the mineral content of the blood or body tissues, they usually indicate a marked stress in which the body is not able to compensate by processes of readjustment and borrowing." He found that the blood of these stricken cattle showed definite evidence of mineral deficiency. It is interesting to note that these animals, deathly sick from apparent starvation, who had probably borrowed all the chemical elements possible from their own stores in order to preserve life, did not develop dental caries. At least such observations are not recorded. I wonder what protective factors are operative in the cow's mouth which prevent her from developing caries when the grasses on which she lives and the milk that she gives are so deficient in minerals.

I am reminded here of some observations of Wallace[6] of England. He criticizes the vitamin fad and condemns the use of milk in the human dietary. He notes that men had better teeth and jaw formation before they kept cattle and made use of dairy products. He believes that milk should be avoided after the natural source, the breast, is no longer present. Cow's milk is meant to supply calves, which develop seven times as rapidly as the human being; Wallace intimates, therefore, that such milk should be protective for man, but we have much more caries today than did the primitive man have despite our use of milk and dairy products. The question here arises, however, as to whether or not primitive man can be compared with modern man. In the early days it was a question of the survival of the fittest. It is probable that only the finest specimens of manhood lived to adult age, and perhaps these possessed the best dentures. Wallace believes that the cleansing properties of the diet are most beneficial and that milk is contraindicated because of the residue it leaves in the mouth.

In December, 1932, simultaneous with the Agnew report, Doctor Price[24] published the results of several hundred chemical analyses of the blood and saliva which he obtained over a period of years from patients immune to caries and patients susceptible to caries. From these results he has developed tests whereby he can determine the caries susceptibility of the patient by an analysis of either the blood or the saliva. He has found that when dried, powdered bone is placed in the blood serum or in the saliva of a normal, healthy person with little or no active caries there is a movement of calcium and phosphorous from the serum or saliva to the powdered bone. In persons in poor health and with rampant caries the movement of calcium is still from serum to bone but it is not so great, while the movement of phosphorous is reversed; that is, phosphorous passes from the bone into the serum. These tests are accomplished by analyzing the calcium and phosphorous content of the serum or saliva before and after it has been exposed to the bone.

By placing the susceptible persons

15McCollum, E. V., et al.: Bull. Johns Hopkins Hosp. 33:202-212 (June 22) 1922.

16Klein, Henry: Science, December 25. 1931, pp. 662-664.

17Lennox, Joseph: Dent. Items of Int. 51:346, 1929 and 52:110, 285, 361, 623, 924, 1930.

18Hatton, E. H.: Caries: A Resumé of Our Knowledge of Its Action, J. A. D. A. 19:1398-1403 (August) 1932.

19Shelling, D. A. and Asher, D. E.: J. Dent Research 13:363-378 (July) 1933.

20Hoppert, C. A.; Webber, P. H., and Caniff, T. L.: J. Dent Research 12:161. 1932.

21Klein, Henry; and McCollum, E. V.: J. Dent. Research 13:69, 1932.

22Rosebury, T., Karshan, M., and Foley, G.: J. Dent. Research 13:379-398, 1933.

23Footnote 11, first reference.

24Footnote 11, second reference.

# TABLE OF THE VITAMINS

## Vitamin A (Fat Soluble). Anti-Infective or Resistance-Producing Vitamin.

Deficiency of Vitamin A may produce:

1. Xerophthalmia and hyperplasia of epithelial cells, particularly of glandular and mucous tissues. Result: Diminution in secretion of such glands.
2. Increased susceptibility and diminished power of resistance to respiratory infections.

*Vitamin A is found in the following foods:

| + | ++ | +++ |
|---|---|---|
| Apples | Beans (green, string) | Butter |
| Beef | Cabbage, raw | Carrots, raw |
| Bread, white (made with milk) | Lettuce | Cod Liver Oil |
| Bread, whole wheat | Green peas | Eggs |
| Lemon juice | Tomatoes | Spinach |
| Baked potatoes | Orange Juice | Milk |
| Bananas | | |

*Vitamin A is rapidly destroyed by oxidation upon exposure to air and slowly destroyed by extreme heat. It withstands cooking well.*

## Vitamin B (Water Soluble). Anti-Neuritic Vitamin.

Deficiency of Vitamin B may produce:

1. Anorexia or loss of appetite.
2. Degenerative changes in the intestinal tract.
3. A tendency to indigestion, constipation, colitis.
4. Decreased reproductive power.
5. Decrease in nerve tone with degenerative changes in the nervous system.
6. Beri-beri or polyneuritis.

Vitamin B is found in the following foods:

| + | ++ | +++ |
|---|---|---|
| Bread, white | Whole Wheat | Yeast |
| Bananas | Spinach | Potatoes, baked |
| Beef | Apples | |
| Carrots, cooked | Beans, green | |
| | Bread, whole wheat | |
| | Cabbage | |
| | Carrots, raw | |
| | Eggs | |
| | Lemon juice | |
| | Lettuce | |
| | Milk | |
| | Tomatoes | |
| | Turnips | |
| | Peas, green | |

*Vitamin B is gradually destroyed by cooking. It is readily destroyed in water.*
*Caution: Do not throw away the water in which vegetables are cooked.*

## Vitamin C (Water Soluble). Anti-Scorbutic Vitamin.

Deficiency of Vitamin C may produce:

1. Hemorrhages in the skin and about the bones—scurvy.
2. Swelling and soreness of joints and limbs.
3. Swelling and soreness of gums.

Vitamin C is found in the following foods:

| + | ++ | +++ |
|---|---|---|
| Milk | Apples | Cabbage, raw |
| Potatoes | Bananas | Lemon juice |
| | Beans, green | Lettuce |
| | Carrots | Orange juice |
| | Turnips | Peas, green |
| | | Spinach |
| | | Tomatoes |

*Vitamin C is rapidly destroyed by oxygen, particularly at high temperatures. It is easily destroyed during cooking, drying, and canning of foods.*

*+Indicates vitamin is present; ++vitamin present in large amounts; +++excellent source of vitamin.

**Vitamin D (Fat Soluble). Anti-Rachitic Vitamin.**

Deficiency of Vitamin D may produce:

1. Cranial tabes; constricted thorax; narrow constricted pelvis.
2. Marked increase in the specific irritability of nervous tissue—infantile tetany.
3. Rickets.
4. Dental: Calcium deficiency—Delayed eruption and malposition of teeth; defective maxillary bone, both form and quality; predisposition to caries.

Vitamin D is found in the following foods:

| + | ++ | +++ |
|---|---|---|
| Beans (green string) | | Cod Liver Oil |
| Butter | | |
| Eggs | | |
| Lettuce | | |
| Peas, green | | |
| Potatoes, baked | | |
| Spinach | | |
| Turnips | | |
| Whole wheat | | |
| Milk | | |

*Vitamin D is not readily affected by temperatures used in ordinary cooking.*

**Vitamin E (Fat Soluble). Anti-Sterility Vitamin.**

It is essential for reproduction. Natural deficiency seldom occurs.

If Vitamin E is deficient there may be:

1. Destruction of germ cells.
2. Fetal death.

Vitamin E is found in the following foods:

| + | ++ | +++ |
|---|---|---|
| Beans (green, string) | Wheat germ | |
| Beef (raw, lean) | | |
| Bread, whole wheat? | | |
| Butter | | |
| Cabbage? | | |
| Carrots? | | |
| Eggs | | |
| Milk | | |
| Peas, green | | |
| Spinach? | | |
| Tomatoes? | | |
| Turnips? | | |
| Whole Wheat | | |
| Lettuce | | |

*Vitamin E is changed or affected very little by heat.*

**Vitamin G (Water Soluble). Pellagra-Preventing Vitamin.**

Deficiency of Vitamin G may produce:

1. Pellagra (Italian leprosy)—recurring, symmetrical erythema which is followed by exfoliation of the epidermis; weakness and debility; digestive disturbances; spinal pains; mental depression.
2. Stomatitis.
3. Degenerative changes in the nervous system.

Vitamin G is found chiefly in lean meat, milk, and yeast.

*Vitamin G is very stable in temperatures used in cooking.*

on a diet rich in the fat soluble vitamins and mineral elements, especially phosphorous, Doctor Price reports that he has been able to control caries in more than 90 per cent of the patients he has treated, including those most difficult and with the most rampant caries. To quote directly, Doctor Price states, "This has been an essential phase of our successful treatment of large clinical groups of dental caries patients by the two procedures of adding more activators to the food and increasing the high phosphorous-carrying foods." With the arrest of decay there also has been an improvement in the blood and saliva reaction as shown by the powdered bone tests.

Again Price states, ". . . Apparently the factor of safety of every part of the mouth will be established by the level primarily of the phosphorous factor of the saliva, and this in turn will be established through the blood stream by the nutrition, which takes us immediately to the activator and mineral content of the food, especially its phosphorous content." Price believes, apparently, that the saliva may influence the carious process in several ways. He suggests that it may have something to do with a modification of the culture medium which influences the growth of acidophilic bacteria. What this modification or influence may be, he does not describe. Price states also that the activators, by modifying the saliva, perhaps modify the ion concentration by releasing the bond of the phosphorous with organic compounds and ". . . probably by some such mechanism as this it enhances the immunizing effect of the saliva."

Clark and Shell[25] in reporting a carefully conducted study of the influence of diet on the inorganic constituents of human saliva make the following statement: ". . . after about a third of the determinations had been completed, it was found that the phosphorous of the saliva was present entirely in the form of inorganic phosphate." If their finding is correct, Doctor Price's speculation in regard to activators releasing the bond of phosphorous with organic compounds is not tenable. Again, Price states as a part of his theory, ". . . Immunity to dental caries is associated with a normal or increasing density of tooth structure." This is supposedly accomplished by a movement of calcium and phosphorous to the tooth substance from the saliva, reasoning analogously from the saliva-powdered bone test. But as Black[26] pointed out in 1898, if caries is initiated by the decalcification of the inorganic portion of the enamel by acidophilic bacteria, no matter how well calcified or how hard the tooth surface may become, it is still soluble in acid. Thus Black believed that immunity to caries could not be accomplished by increasing the hardness of the tooth surface but could be prohibited only by the prevention of acid formation on that surface.

None of the phosphorous advocates has shown as yet by what mechanism that element is able to prevent or arrest dental caries. To my knowledge, it has not been shown conclusively by chemical means that immune teeth have a different phosphorous content or that they otherwise differ chemically from susceptible teeth. On the contrary, Maxwell Karshan[27] of Columbia University conducted an experiment on rats in which he showed that animals fed a severe rickets producing diet, but nevertheless a diet permitting good growth, showed a marked reduction of calcium and phosphorous in their bones compared with the bones of animals on normal diets. However, chemical analysis of the incisor teeth of the rachitic rats showed no appreciable variation in their mineral content as compared with the teeth of the normal rat. When the incisor teeth of rats, which develop continuously, are not affected chemically similar to the bones, it is difficult to imagine that permanent teeth, fully erupted and developed, could be appreciably altered.

Back in 1886 Miller[28] published the results of an interesting dietary experiment he performed on dogs in which he tried to determine the influence of diet on their teeth. He extracted one cuspid from each of three dogs. He then placed the dogs on a mineral deficient diet for three months. At this time another cuspid was removed. The dogs were then fed on an improved diet for fifteen weeks, following which another similar tooth was extracted. Each tooth was analyzed chemically after its extraction. Miller was unable to find at that time any significant change in the composition of the teeth. He also asserted that an analysis of various foods showed that the average diet for human beings was probably safe in phosphorous but was deficient or nearly so in calcium.

Definite evidence of a change in the phosphorous content of the saliva as it relates to caries is also lacking. McCollum, Klein, and Agnew intimate that the saliva is the medium through which protection is established. But their suggestion, to my knowledge, is not based on any experimental proof as yet published. While Price has shown a difference in the reaction of the phosphorous of immune and susceptible salivas when exposed to powdered bone, he has not yet shown to my knowledge any difference in the phosphorous content of the various salivas.

Clark and Shell[25] found that resting saliva contained from three to five times as much inorganic phosphorous as did blood plasma. While they believed that this is of considerable importance in that it provides the saliva with an efficient buffer system, unfortunately, they did not correlate their observations with the dental condition in order to determine whether or not immune mouths contained more phosphate buffers.

Forbes and Gurley[29] studied the effects of diet on six persons ranging from immune to susceptible. They found no relation between the acid neutralizing power of the saliva and its phosphorous concentration.

Karshan, Krasnow, and Krejci[30] have published their observations from a study of the blood and saliva of forty-four dental students, seventeen immune to caries, six arrested, and twenty-one susceptible. They observed the hydrogen-ion concentration, the titrable alkalinity, the calcium, and the phosphorous of the saliva. They could find no conclusive differences between the caries immune and susceptible salivas, although they did find the average phosphorous values somewhat greater in the immune than in the susceptible.

Horton, Marrack, and I. Price[31] examined the saliva and teeth of 741 children with special reference to calcium. They found the average calcium content of susceptible saliva to be lower than that of immune. They estimated the inorganic phosphorous in the saliva of fifty-four children. From this finding they state, "As far as any conclusion can be drawn from this number, the inorganic phosphate does not vary with the extent of caries."

M. Roskins,[32] who worked in conjunction with Doctors Boyd and Drain at the University of Iowa, studied the salivas in two groups of children, one under dietary treatment for diabetes and the other not

(*Continued on page 25*)

25Clark, G. W and Shell, J. S.: Dental Cosmos **69**:500-605, 1927.

26Black, G. V.: Dental Cosmos **40**:449, 1898;

27Karshan, Maxwell; Proc. Exper. Biol. & Med. **27**:200, 1929-1930.

28Miller, W. D.: The Density of the Teeth as Influenced by the Food and by the Administration of Lime Salts, Independent Practitioner **7**:597-605, 886.

29Forbes, J. C. and Gurley, W. B.: J. Dent Research **12**:637-645, 1932.

30Karshan, Maxwell; Krasnow, F., and Krejci, L.: J. Dent. Research **11**:573-589, 1931.

31Horton, K.; Marrack, J., and Price, I.: Biochem. J. **23**:1075-1078, 1929.

32Roskin, M.: Proc. Soc. Exper. Biol. & Med. **25**:465, 1928.

Ritter
COUNSELOR

# "That's the Tooth, Doctor!"

## But only with a Bite-wing Interproximal X-ray examination can you be certain!

HOW many times in your experience has a patient pointed to a tooth and said, "That's the tooth, Doctor?" And, how many times has your exploration on that particular tooth revealed that it was perfectly sound and was simply reacting sympathetically to another molar which was really affected?

Perhaps you've even made what you considered a thorough examination of the tooth indicated; found nothing apparently disturbing it, dismissed the patient—and had her return a few days later, as one dentist's patient did, with the whole interproximal side broken off an upper bicuspid!

Experiences like those occur all too frequently in any dentist's practice. They're unfortunate—yes; but they're also inevitable and perfectly natural as long as ocular and instrumental methods are the ones most widely used in examining teeth for interproximal cavities, caries and other pathological conditions. No amount of care, no supposed thoroughness of exploration can possibly reveal all interproximal cavities. They are undoubtedly the most serious of all the primary effects of dental caries because they are the most completely hidden.

Nor are interproximal cavities the only potentially serious condition which remain undiscovered when ordinary methods of making interproximal examinations are used. It is entirely beyond the capabilities of any experience or the most highly trained eye to find deep-lying, concealed conditions like isolated pyorrhea pockets; unerupted third molars; bone destruction due to ill-fitting crowns and overhanging fillings; fillings entering the pulp chamber; broken-off roots beneath the gum line; pulp stones; calculus and incipient osteoclasia.

It is not only impossible for conditions like these to be discovered by the naked eye and instrumental exploration—it is also economically unsound even to attempt to do so. No matter what valuation a dentist may put upon his time, it is a definite and decided loss to devote the amount of time and energy necessary to make even the most superficial ocular and instrumental interproximal examination.

Think of it! With a full complement of teeth, there are sixty interproximal surfaces to be examined. Allowing a minimum of 30 seconds for every surface, the conscientious practitioner must spend one half hour examining and noting cavities and localities where caries have made a start. Even then, after expending so much valuable time and energy, the dentist cannot be sure he has not overlooked any actual or incipient cavity. He is bound to miss completely any "deep-seated" conditions. His eye and his explorer cannot reveal pathology existing below the gingival margin.

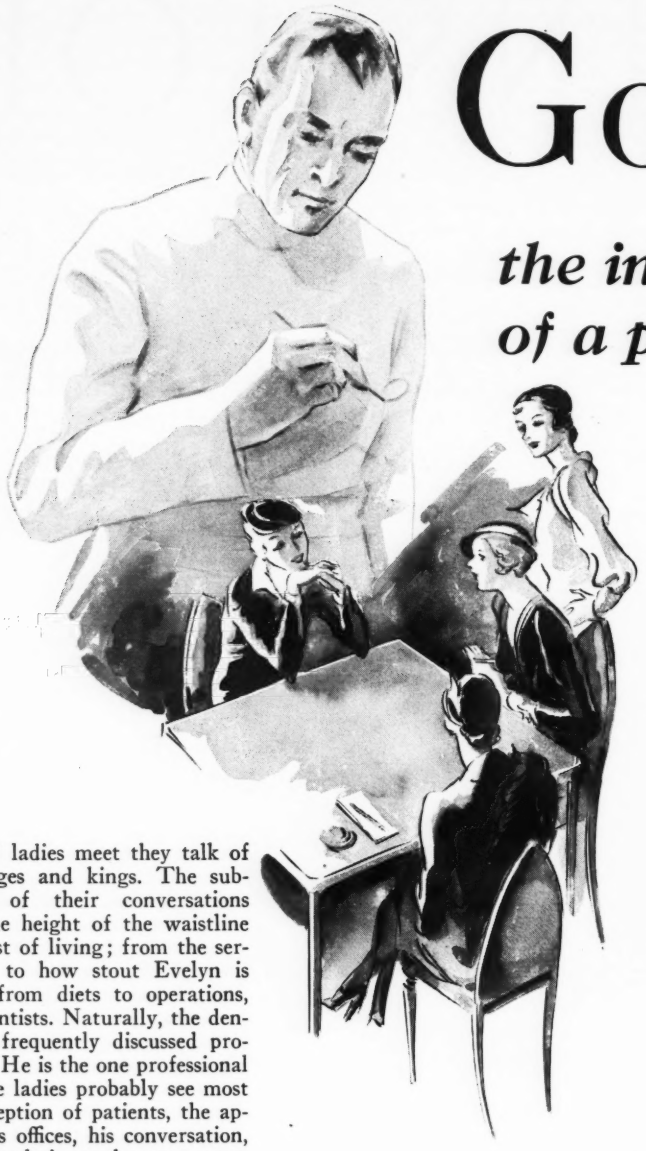
Yet almost every mouth has these hidden cavities and mephitic spots. Thousands of them are discovered when least expected. *Discovered only by an X-ray examination.*

Thanks to Dr. Howard R. Raper's experiments, bite-wing film technic has simplified and perfected the interproximal examination to a high degree. Using bite-wing films, a complete five film interproximal examination can be made in five to ten minutes—a shorter time than is often required to separate the teeth and examine two interproximal surfaces. Periodic interproximal examinations, in which the X-ray and bite-wing films are used, are firm foundations upon which to build the new dentistry. They are the surest weapons against the pulpless tooth which has rightfully been described as dentistry's greatest respon-

(*Continued on page* 22)

# Gossip—

## *the insidious enemy of a professional prac*



WHEN ladies meet they talk of cabbages and kings. The subjects of their conversations range from the height of the waistline to the high cost of living; from the servant problem to how stout Evelyn is getting; and from diets to operations, doctors and dentists. Naturally, the dentist is a very frequently discussed professional man. He is the one professional man whom the ladies probably see most often. His reception of patients, the appearance of his offices, his conversation, his operating technique, the very manner in which he selects his operating instruments—all are discussed. All form the basis for gossip which may be either favorable or unfavorable.

And this gossip—spread by laymen who know little or nothing of dentistry—can literally make or break a practitioner. The opinions of his patients govern to a large degree, a dentist's professional success or failure. A typical result of prejudiced and unfavorable opinion is the frequency of claims for malpractice; claims which can be based on any number of different reasons from antiseptic carelessness on the part of the patient to unintentional carelessness on the part of the dentist.

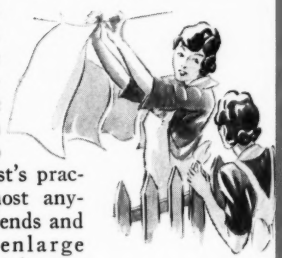
As it happens, the largest proportion of claims for malpractice are based on post-operative infection.* Obviously, a certain percentage of these claims is undoubtedly due to antiseptic carelessness on the part of the patient or to food particles lodging and decaying within the area of the extracted teeth.

*But every one of the claims for post-operative infection might well be laid to unsterile instruments.* Improperly sterilized instruments *could* be the root of the whole trouble. Every claim made by patients might very possibly be based not on inefficient operating technique; not on carelessness on the part of the patient or practitioner—but on the mechanical inefficiency of the obsolete or time-worn instrument sterilizer in the dentist's office.

What's that you say, Doctor? You are protected against such claims by your blanket policy of malpractice insurance? That's true. As one of the 56,000 or more dentists in the country, you contribute your share toward the approximate total of $800,000 or more the dental profession pays annually as premium for malpractice insurance policies.

And you say that the annual premium of $15.00** you personally pay for malpractice insurance in an inconsiderable sum. That it is worth far more than that to be protected against unscrupulous people who see an opportunity to make some "easy money" by entering claims against you. That also is true.

But, Doctor, you must also take this into consideration. Think of the harm these damage claims—legitimate or otherwise—can do to your practice even though they are not actually brought against you. Every one of them is discussed again and again. Every one forms the basis for the type of gossip which does more to injure a dentist's practice than almost anything else. Friends and sympathizers enlarge upon the original statement. Knowing nothing of the real facts of the case, these friends and sympathizers require but little time to build up comments like this: "Oh, yes, you mean Dr. Blank. Well, personally I wouldn't advise anybody to go to him. My mouth has been sore as a boil ever since he pulled that tooth. He must be awfully careless because I got an infection in my mouth right after I went to him. I can't see any possible explanation for it—except that his instruments couldn't have been clean."



That is why it is vitally important for every dentist to stop up such loop-

*In 1932 eighty claims for post-operative infection were entered through one insurance company.

**Estimated.

holes for unfavorable gossip. That is why he should have a modern sterilizer which not only gives *him* complete confidence in the efficiency of his sterilizing procedure, but which, by its very appearance creates that same feeling of confidence in his patients. That is why every dentist owes it to himself to obviate any possibility for claims being made that his instruments were improperly sterilized.

To make instrument sterilization completely automatic, fool-proof and annoyance-free was the goal set by Ritter engineers. And that was the goal they reached after months of research and experiment. During the experimental period sterilizers were produced which were above the average; sterilizers, having many refinements not found in the ordinary instrument sterilizers. But they were rejected. They fell short in some particular. They lacked the complete freedom from annoyance which was being sought.

Finally the Ritter Model "A" Sterilizer was perfected and introduced, and was heralded as the greatest advancement in dental sterilization because it represented the first definite step forward in the elimination of many of the annoyances and inconveniences common to the ordinary dental sterilizer. That was more than two years ago.

But it was not until the new RITTER MODEL "C" STERILIZER was introduced just recently, that all of these *same* wonderful automatic features were made available in a *popular priced* sterilizer. Dentists who have seen this new sterilizer have been honestly and unanimously enthusiastic about it. They realize that the Model "C" Sterilizer overcomes all of the deficiencies of ordinary sterilizers.

Only in a Ritter Sterilizer is it possible to obtain the many exclusive features found in this NEW Model. It has a conveniently located water reservoir which holds an ample supply of water for at least a full day's continuous operation. The necessity and annoyance of frequently replenishing the water in the sterilizing tank has been completely eliminated. The water in the sterilizing tank is maintained at a constant and correct level by gravity feed from the water reservoir which replenishes the water as it boils away during the sterilizing process.

Another outstanding and radical improvement over ordinary sterilizers is the Water Conditioner which pre-heats and pre-sterilizes the water from the reservoir before it reaches the sterilizing tank. Due to this exclusive Ritter feature, no unsterile water can reach the instruments to be sterilized. The danger of possible contamination of instruments by cold water added manually during the sterilizing process has been entirely eliminated. In addition, the water conditioner does away with all delay—all waiting for the water in the sterilizing tank to reach the proper temperature for completely effective instrument sterilization.

The water conditioner also plays an important part in eliminating excess lime from the water and preventing the sterilizing tank from being incrusted by lime deposit. In the Ritter Model "C" Sterilizer the excess lime is deposited in a trap below the water conditioner from which it can easily and quickly be drained off. The heating efficiency of the sterilizing tank is therefore never lowered by a thick crust of lime deposit.

An automatic safety switch assures complete protection of the equipment. Its operation is completely automatic and is governed by the water level in the sterilizing tank. When the water falls slightly below the normal level the automatic safety switch completely shuts off all current. This condition is signaled by the pilot light on the face of the cabinet.

The current to the sterilizing tank is automatically regulated by a thermostat built into the sterilizing tank itself. By means of this automatic thermostat, proper sterilizing temperature is always maintained and economical operation assured. As soon as the boiling point is reached, the ingeniously designed thermostat *automatically* reduces the electrical energy to a point where approximately only *one-third* of the amount of current is required to maintain a constant sterilizing temperature, representing a material saving in operating costs.

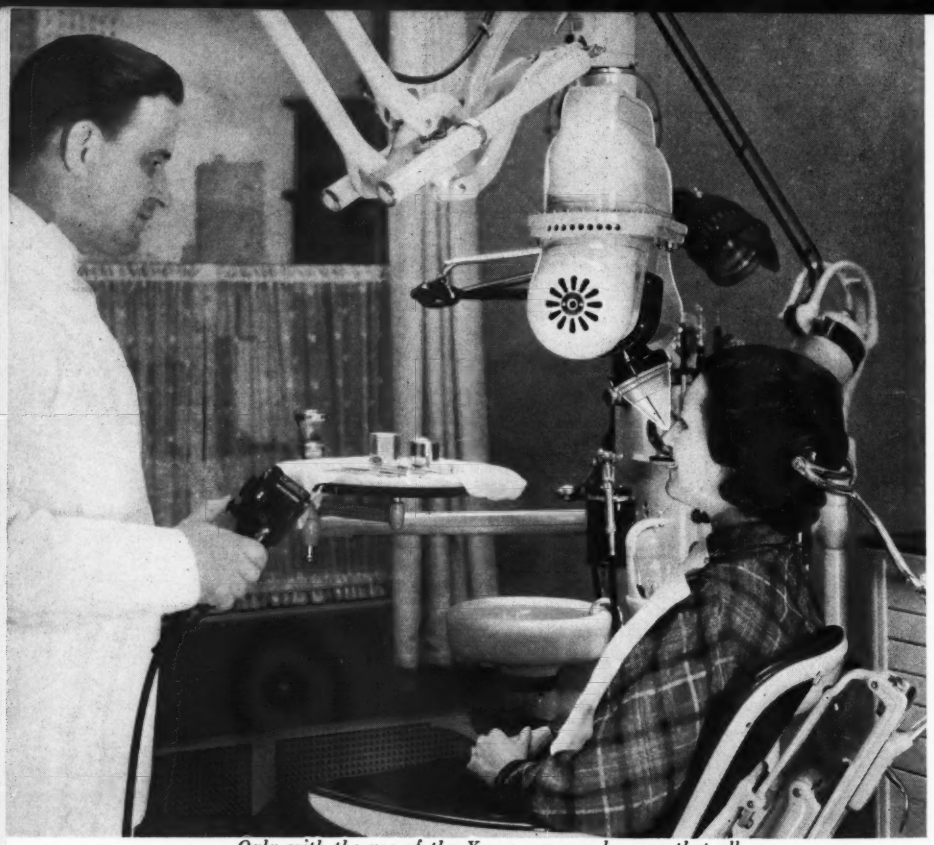
Nor are these advantages the only ones brought to the dental profession by the Ritter Model "C" Sterilizer. Not one single feature essential for efficient, trouble-free sterilization has been overlooked in this new Ritter Sterilizer. From the porcelain base to the porcelain top, it is designed for the dentist by men who know his requirements and who appreciate his desire for a completely annoyance-free sterilizer which makes sterilizing procedure completely automatic and 100% efficient 365 days in every year.

The Ritter Model "C" Sterilizer, Doctor, is unquestionably your strongest defense against the insidious enemy of professional practice—*gossip*. It has been produced as a decisive fortification against the "infection claims" which make up the largest percentage of all claims entered against dentistry.

To make use of a Ritter Model "C" Sterilizer in your office means that you obviate the greatest number of possibilities for gossip based on post-operative infections. Can you afford to overlook this fact—and to ignore the manifold benefits and advantages brought you by the Ritter Model "C" Sterilizer? Can you honestly say "I don't need it?" We think not—and therefore we urge you to make a full investigation of the new Ritter Model "C" Sterilizer and consider the possibility of making it an integral part of your professional equipment. This sterilizer like any other item of Ritter Equipment may be purchased on the liberal Ritter Deferred Payment Plan. And remember this . . . no matter what you paid for any other sterilizer you *could not* obtain one which would offer you *all* of the *exclusive, automatic* features of the New Ritter Model "C" Sterilizer; nor give you the "peace of mind" which this sensational sterilizer assures.

Literature and complete details on the Model "C" Sterilizer will be gladly sent you upon request.

*Showing the convenient location for the Water Reservoir on the new Ritter Model "C" Sterilizer.*



*Only with the use of the X-ray can you be sure that all mephitic conditions in the teeth have been discovered.*

## "That's the Tooth, Doctor!"

(*Continued from page* 19)

sibility. They are not, however, and should never be considered a substitute for the general periapical X-ray examination.

Bite-wing film radiographs are something different, used for an entirely different purpose. The interproximal X-ray examination has as its main purpose the *prevention* of pulpless teeth, while the main purpose of the periapical full-mouth dental X-ray examination is to observe diseased teeth after the damage has been done. A patient suspected of devitalized teeth or suffering from systemic disturbance, needs a general, periapical X-ray examination and the interproximal survey cannot be substituted. On the other hand, every patient who is apparently healthly needs the interproximal examination. It can be safely said, and said without exaggeration, that everybody with teeth is interested in their preservation and needs a *periodic* interproximal bite-wing film X-ray examination to retain them at the minimum cost and with the maximum of safety. These bite-wing interproximal radiographs should be made annually or semi-annually—according to the case—until age thirty. After thirty people are less susceptible to dental caries and you may safely wait two years between bite-wing surveys.

If they are made at the recommended intervals, interproximal examinations will keep the amount of decay in the mouth at the lowest possible minimum at all times and will, in this way, reduce the aggregate amount of decay occuring. Detecting cavities and filling them when they are small, as Dr. C. N. Johnson pointed out more than a decade ago, does more than merely limit decay in the teeth thus treated. It also lessens the tendency to decay in other teeth in the same mouth.

Bite-wing interproximal examinations are the firmest foundations upon which to build the *new preventive dentistry*.

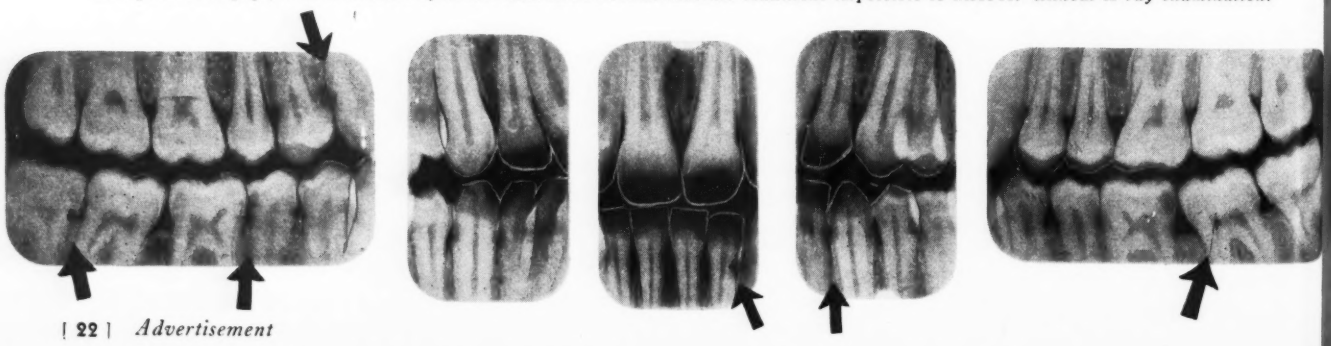
Changed economic conditions make it impossible for the majority of people to pay for really thorough, effective and scientific treatment of their teeth *after* pathologies have developed. Modern dental treatment must adhere exactly to the rigid laws of modern aseptic surgery which is inevitably too expensive for the average person to afford. On the other hand, bite-wing film interproximal examinations, which require only half as much time and only half as many negatives as a full mouth periapical examination might otherwise be necessary, are naturally only half as expensive . . . and only a fraction as costly as the old and still-prevailing method of allowing teeth to ache and then attempting to "fix" them after the pulp itself had become affected.

For a moment place yourself in the circumstances of the patient. Aside from the suffering entailed, think of the needless expense which results if the "treating" procedure is followed and fails. Suppose a tooth has been neglected until it aches and gives Nature's compelling danger signal. A dentist is visited, the affected tooth is carefully treated; root canals are filled and the tooth is crowned. Later on, rheumatism develops. There are bills for medical treatment, druggists' bills and a decided loss of earning power. Finally, a periapical X-ray examination of the tooth in question is made. Extraction is recommended and performed, the bone curetted and finally a three-tooth bridge is made. Compare the cost of a procedure like this with that of periodic interproximal examinations, using bite-wing film technic which would have discovered the incipient condition in the tooth at the very start and made it possible for simple, effective measures to be taken without delay and before decay had reached the pulp chamber.

Interproximal radiographic examinations, using bite-wing films are definite practice builders and for that reason, if for no other, merit earnest consideration. Moreover, they are the only sure weapons available at the present time against the pulpless tooth, the danger of which becomes more apparent with each advance in our knowledge of metastatic degenerative diseases. Bite-wing film interproximals made at regular intervals can prevent the pulpless tooth.

Sharpness of detail and a registration of the most minute deviation from the normal will result from a simplified technic made possible with the exclusive features of the Ritter X-ray unit. It will banish many of the worries of your practice.

*This type of X-ray examination discloses needed dentistry found in the ordinary mouth and is the type which the patient is usually in a position to pay for as a measure of health insurance. Arrows indicate conditions impossible to discover without X-ray examination.*



(*Continued from page* 16)

under dietary control. The incidence of caries was high in the nondiabetic group while caries was largely arrested in the diabetic group. She found that the variations in the calcium, phosphorous, chlorides and hydrogen-ion concentration were similar for the two groups, indicating that the arrest of dental caries noted in the diabetic children under dietary control was probably not due to any marked differences in the mineral content of the saliva.

### Conclusion

It would seem from the conflicting observations and hypotheses of these investigators that proof is still lacking for the suggestion that caries is associated with a change in the phosphorous content of the saliva. The answers to the questions concerning diet asked in the first paragraph of this article are still perplexing. Until we are supplied with some concrete evidence as to exactly how diet is related to caries the various investigators will continue to advocate the use of this or that food factor as particularly important in the prevention and arrest of caries. Many, of course, prescribe a so-called well balanced diet which is probably the safest position to take, considering the present status of our knowledge. The latter method, however, will not prove simple, for a difficult task confronts us if it becomes necessary to regulate the entire diet of the person throughout life in order to prevent dental caries. It would be easier to reach the panacea of dental ills for which the investigators are earnestly seeking if it could be accomplished by the daily ingestion of a few capsules containing one or more of the mysterious vitamins, elements, or substances that are being advocated in the literature today.

1838 West Harrison Street.

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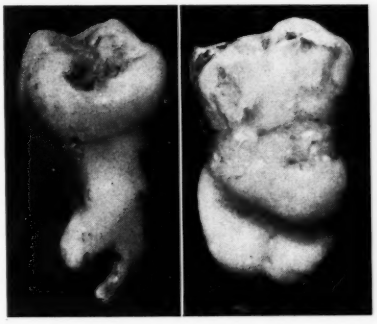
# ABNORMALITIES OF IMPACTED MANDIBULAR THIRD MOLARS

GEORGE F. SEEMAN, D.D.S.
Nashville, Tennessee

EVERY operator is familiar with the hyperesthesia, paresthesia or hypesthesia associated with the removal of impacted third molars. The accompanying illustration shows two teeth recently removed which had been impacted. These teeth have abnormal formations to accommodate the inferior dental blood vessels.

A notched condition is shown in A at the apical end while B shows a well defined groove through which the mandibular nerve, artery and vein traversed.

Occasionally the patient is concerned because of numbness of the lower lip and angle of the mouth. Such a condition is due to trauma, infection, local anesthesia or hematoma (blood clot). The numbness may disappear in from five days to several weeks. Almost every lingual roentgenogram of the lower third molar shows the inferior dental canal and its relation to the tooth roots. It is important for the operator to keep this inferior dental canal in mind, and if necessary explain to the patient before operation the possibility of numbness. My experience and the experience of others shows that 95 per cent of the cases of numbness are only of temporary duration.



A B

**A notched condition is seen at apical end of A; B shows well defined groove through which the mandibular nerve, artery and vein traversed.**

436 Doctors Building.

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## COMING

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**WHY DENTAL CARIES WITH MODERN CIVILIZATIONS?**

**By Weston A. Price, D.D.S., M.S., F.A.C.D.**

**Beginning February, 1934**

# The Editor's Page

IN a country with an area more extensive than that of the United States and Canada combined, which occupies one-sixth the land surface of the earth, with a population of 165 million persons, with climatic conditions that vary from tropical to polar, with rich treasures of natural resources, the greatest economic experiment in history is being performed. In a planned and state-monopolistic economic order that is built upon the ideal of an "almost complete abolition of the motive of private profit" one would expect the complete socialization of health services.

What information comes out of Russia is too often colored by preconceptions, prejudices, and propaganda. There is too much pro-communism and too much anti-communism; the two are equally bad. Dentists and physicians should be interested in an objective account of health activities in Russia. This they may find by reading RED MEDICINE by Sir Arthur Newsholme and John Adams Kingsbury (published by Doubleday-Doran). Newsholme is internationally known for his surveys of health work and medical practice in European countries; he is a physician. Kingsbury, an American, is an executive officer of the Milbank Memorial Fund. This Fund, in common with other funds and foundations, has been interested in public health. Although members of the professions have not always seen eye-to-eye with these philanthropic organizations and we have often been aware of the grim paradox of ironmongers, oil barons, sweat-shop operators, and other piratical business people being converted in later life to philanthropy, we should in this case accept Mr. Kingsbury's co-statements as sincere, objective, and without ulterior motives.

There is no evidence in the book that the authors have intended the work as propaganda for socialized medicine in the United States. In their own words: "We plead no cause; our only aim is to give a faithful account of what we have seen . . . As our aim is to record rather than to judge we refrain from general comments." Generally speaking, they were highly successful in this promise to their readers.

Briefly, here are a few facts concerning medical activities in Russia: Medical care is furnished gratuitously (State paid) to urban and rural workers in dispensaries, polyclinics, and hospitals. Because of the unsatisfactory housing conditions little care is given in the home. The services vary in character from excellent in large industrial cities to very poor in remote rural regions. Because, however, all medical workers are for practical purposes officials of the State—educated and paid from State funds—this unequal distribution of medical personnel may easily be corrected by decree.

Physicians, dentists, and nurses work six or six and one-half hours a day, with every fifth day a holiday. An annual vacation of two weeks is allowed. Although private practice is permissable, it is estimated that it comprises less than 10 per cent of practice. Older and well established practitioners do most of the private work. Younger practitioners do little private work, and practically all, so say the authors, favor state medicine. In some districts free choice of physician or dentist is permitted the patient.

Candidates for medical training are selected without discrimination as to age, sex, or previous occupation. A middle-aged sailor or factory worker may become a medical student if selected by the proper committees of fellow-workers. As the status of men and women is exactly the same in the communistic order with regard to citizenship, occupational choices, salaries, there are many women engaged in medical activities in Russia. The medical course is now five years with constant emphasis on practical training. Tuition is free and the student is also paid.

In 1912 there were six medical colleges in Russia and no institutions for medical research; in 1930 there were thirty-four medical colleges and 106 institutions for research.

Dental services are considered a part of the coordinated activities in medical centers. Although dental care is inadequate in many regions, it is obligatory in all schools.

# A SIMPLE TECHNIQUE TO INSURE SMOOTH CASTINGS

J. E. SHULTZ, D.D.S.
Pella, Iowa

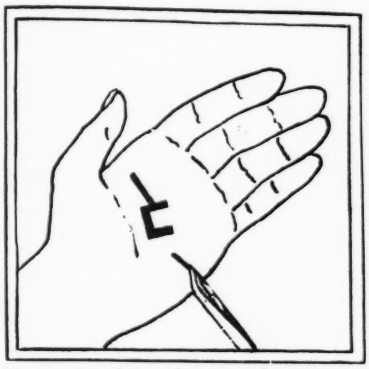

Fig. 1—Attaching chimney plug to wax pattern and sprue.

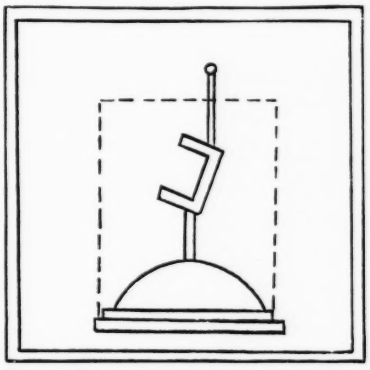

Fig. 2—Chimney plug above ring, ready to invest.

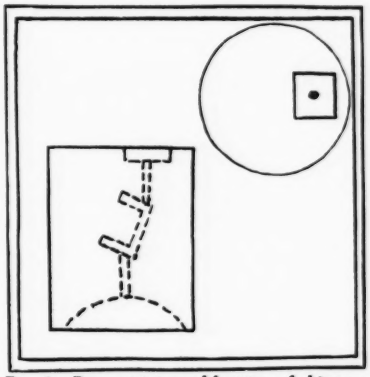

Fig. 3—Box cut into mold at top of chimney ready to place in oven.

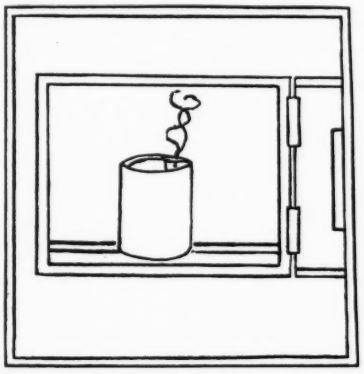

Fig. 4—Vapor and smoke issuing from chimney while in oven.

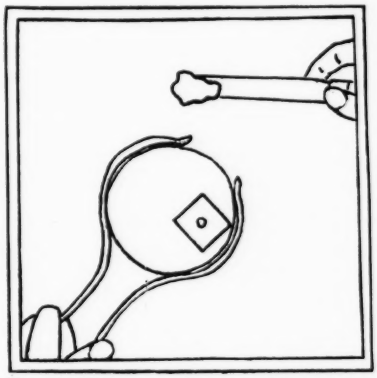

Fig. 5—Closing up box on chimney just before casting.

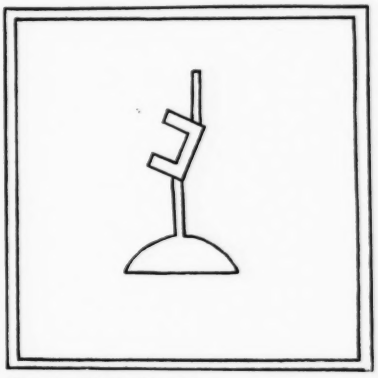

Fig. 6—Finished casting.

WITHIN the last few years there has been such improvement in inlay investments that with a little practice it is possible for any operator to make satisfactory castings. No matter what type of investment or technique I have used, however, I have found that in the case of the large mesio-disto-occlusal or three-quarter crown the surface does not have that high luster that the smaller inlays have when cast. To be certain that all inlays were made in the same way, I have used the same mix of investments and the same temperatures for both small and large inlays. The results were always the same; the larger castings lacked the luster and smoothness of the smaller castings.

As the investments and temperatures were identical this difference in the luster and smoothness, it seemed to me, was due to the amount of wax to be carbonized on the investment. To compensate for this extra carbonizing I use a "chimney" while burning out the wax.

## Technique

Whatever investment and technique one is accustomed to may be used. To the upper part of the wax pattern and approximately parallel to the sprue another small sprue or "chimney" plug is added to extend above the ring as is shown in Fig. 2. The pattern is invested with either one or two investments according to the particular technique used.

When the mold is ready to be placed in the oven the sprue and former are removed, but before the chimney plug is removed, one should cut around it and make a small box depression about one-eighth inch deep and one-fourth or one-half inch square, as shown in Fig. 3.

The mold is placed in the oven and burned out. One will be able to see smoke or vapor come out of the chimney from the time the wax starts to burn out until a few minutes before it is ready to cast. In some of the large castings the wax will even bubble out of the top of the chimney.

When the mold is ready to cast it is removed from the oven and a small amount of modeling clay or freshly mixed investment is placed in the box to close up the top of the chimney in order that the gold may not be forced clear through while casting. I prefer the modeling clay.

By this simple addition to an ordinary technique I have been able consistently to make large inlays with as high a luster as the small inlays.

Another advantage of this chimney is that it eliminates the danger of trapping air or vapor in the mold while casting.

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## LETTERS TO THE EDITOR

"A short time ago I wrote a letter canceling my subscription to THE DIGEST. I thought I could not afford it this year, but I find I refer to it many times for information, and have had my attention called to many articles that appear in it. So I feel I must renew my subscription for 1933."—P. E. HUTSON, D.D.S., *La Crosse, Wis.*

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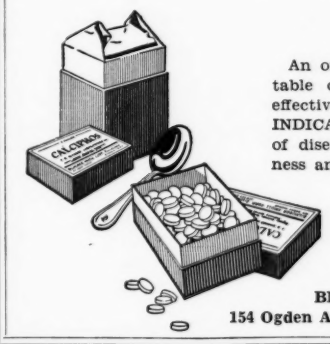


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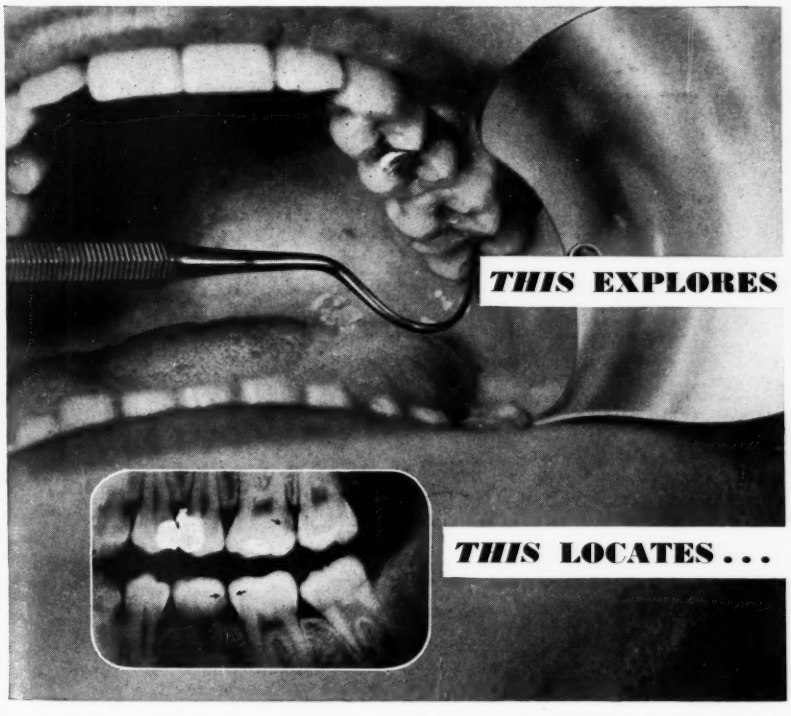


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"I recently sent you a postcard asking discontinuance. I wish to recall that decision, and to continue my subscription without the missing of an issue, and what is more, please send me another copy of the April number, as that chart is the finest I have ever seen upon the progress of decay, and I have given my number to our County Nurse, hence my need of the April issue, and see also that I get the May issue, and bill me direct."—H. W. MCMILLEN, D.D.S., *Roseville, Ill.*

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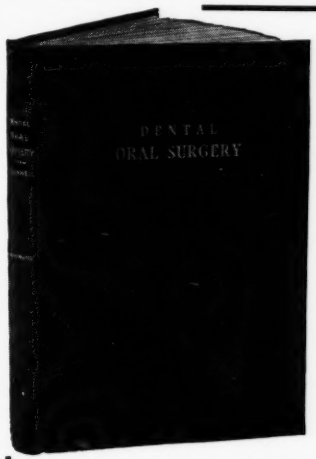


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